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PREFACE.

In a year in which the community generally has suffered so much from financial difficulties, and in which the government occupied with party discussions and foreign wars, we may esteem it fortunate that both in architecture and engineering no retro has taken place. Although architecture has no great memorials of the present year to show us, yet its labours have been great, prospects are most promising, and if neither remarkable for the completion nor the commencement of any gigantic design, it ca be denied that the present is a period of the brightest augury. The necessity for the New Courts of Law may be considered as a ledged, while the appointment of new judges makes their erection more urgent, the appointment of a commission to consider way the Fine Arts can best be made available in the New Houses of Parliament, with the addition of the Victoria Record Tower plan of that building, the recognized advantage to be derived from the embankment of the Thames—all these are circumstances are calculated to inspire the greatest satisfaction.

While prospects of employment are being opened to the profession, its general advancement may be looked upon with equal ple the question of competition is one which has been much agitated during the present year, and good can scarcely fail to arise fr mode in which the extra-professional press have entered into the discussion. The arts have for the first time been made a part of g education by the appointment of Mr. Dyce, at King's College, to a professorship of this branch of instruction, and in the same in a school of architecture is also formed, so that architecture may henceforth be regarded as adopted into the university system legislature in the late session took, upon a bold and comprehensive scale, a plan for the application of architectural police and hyg political difficulties alone retarded measures, the principle of which was generally admitted. In the sister country the late repre of the crown followed up the bestowal of royal patronage on the Institute of Irish Architects by conferring on its president Si Morrison, the honour of knighthood, and in the present Viceroy, the long honoured President of the Institute here, we hop generous encourager of all the liberal arts. The extension of museums, and the re-opening of Westminster Abbey are measure to promote the moral welfare of architecture, while its material interests have not been neglected. A general improvement a of the royal parks has been commenced, the Green Park, Hyde Park, Regent's Park, and Windsor Park are undergoing ext tions, a new Royal Kitchen Garden is to be formed, the Kitchen Garden in Kensington Gardens removed, the East of Lo proved by the opening of Victoria Park, and other Parks are contemplated in the South. The new streets in the met improvements in Trafalgar Square have proceeded but slowly, but the difficulties with regard to them have now been new street to the Post Office has however been cleared, and the approaches to the Royal Exchange nearly completed. large body of masons caused considerable delay with the Houses of Parliament and the works in Trafalgar Square, buildings have gone on well. The Royal Stables at Windsor and the Wesleyan Centenary Hall, have been completed Hospital has been extended, the Lock Hospital commenced, and a Gresham Lecture Hall: restorations and [illegible] the Cathedral of Hereford, Westminster Abbey, the Chapel of St. George Windsor, and King's College Cambridge; and the R Churches in the Temple and at Cambridge; many new Churches have been erected in various parts of the country. The demoliti the old front of the British Museum has commenced, to make way for a new one, but we have this year lost the Great Armoury i Tower, Astley's Amphitheatre and Vauxhall. The greatest loss architecture has sustained has been by the death of the illust Schinkel.

Directing our attention to engineering we find the converse of what we have observed with regard to architecture, for many n works have been completed, while the continuance of legislative restrictions threatens to check the progress of every department of engineering. It may be said, without any important exceptions, that neither for railways, canals or harbours has any act been passed, mechanical engineering alone remains unscathed. The government instead of affording relief to engineering, brought forward meas which must still further have depressed it, had they not been defeated in the attempt.

In the Colonies we have to notice the increased employment of engineers, particularly in New Zealand. The Bengal Governn have at last published a report on the public works, executed by them, and it appears that the other Indian governments have of late stimulated to carry on extensive improvements of the canals and roads of India.

With regard to the institutions we feel it our duty to point out as a deed worthy of the profession and of the man, the munifi conduct of President Walker, who presented to the Institute one thousand pounds consols as a prize fund. The Institute has show praiseworthy disposition to commemorate the great men of the profession, by calling for a series of memoirs. Dublin has been ad to the number of engineering universities, courses have been opened in University College, a school is proposed at Manchester, a ju school has been opened at King's College, and a school for engine drivers at the Polytechnic Institution. The first benevolent inst tion connected with the profession has been founded for the relief of workmen, by the mechanical and marine engineers.

It is with pleasure we chronicle among the events of the year, the knighthood of Sir Isambard Brunel, and the completion of great works of himself and his son, the Thames Tunnel and the Great Western Railway. The King of the Belgians has also confe the order of Leopold upon the younger Stephenson.

PREFACE.

...ost striking features of this year has been the number and importance of the scientific questions which have been ... relate mostly to the phenomena of steam and the construction of engines, impelled by it. They include the discussion ...ctricity of steam, on the percussive action attributed to it, on the comparative merits of Cornish and other engines, and of four ...wheel locomotives, and on the combustion of coal. The plans for the improvement of the river Irwell were also made the subject ...c disputation, in which several engineers of eminence took part.

...deaths among eminent men connected with the profession have not been numerous; they are those of Francis Bramah, the engi... Rickman, the author of the Life of Telford, and Sir Francis Chantrey, the eminent sculptor.

...year has witnessed the completion of nearly all the railways, for which acts have passed, and we may date from this period ...ishment of a connected railway system. The number of miles executed this year is under two hundred and fifty, but the Great ...South Western and Gosport, Manchester and Leeds, Brighton, Stockton and Hartlepool, and Blackwall Railways have been ...roughout. Additional and partial openings have taken place of the Bristol and Exeter, Manchester and Sheffield, Cheltenham ... Western, North Eastern, Maryport and Carlisle, Glasgow and Greenock, and Ulster Railways. The Greenwich line is being ...and the locomotive system has been extended to the Cromford and High Peak Railway. The sudden and unaccountable occur... serious accidents on the lines in the autumn of the last year and of the present, gave rise to violent attacks on the railways from ..., and to the suggestion of stringent measures on the part of the Board of Trade, which was however defeated in the attempt. ...ficiency of the Act of last year has been signally shown by the closing of the Brighton Railway shortly after the government ...r had pronounced it to be not only in an efficient state, but to be the best executed work of any that he had seen. A bill for rail... Ireland was introduced by the government, who were compelled to modify it, and it has since been postponed. Not only our ...s, but our workmen, have been called abroad for the execution of the Paris and Rouen Railway, and the Suspension Bridge over ...ube at Pesth.

...od pavement has been adopted in the neighbourhood of chuches and courts of law, for the purpose of deadening the sound, and ...en laid down on an extensive scale in several of the principal thoroughfares of the metropolis.

...repairs of the bridges over the Thames have been proceeded with, and an extensive embankment of the river is contemplated; ...gerford Suspension Bridge is in progress, the Thames Tunnel has been opened throughout, and the lighthouse with Mitchell's ...orings on the Maplin Sands has been finished. A lighthouse on the same construction has been erected at Fleetwood, and many ...ents made in the harbour there. A lighthouse entirely of iron has also been constructed in this country and sent out to Jamaica. ...at Southampton notwithstanding many difficulties are nearly ready for opening.

...tended use of iron steamers, with that of auxiliary steam power, and the attention devoted to the forms of propellers are the ...gs which strike us with regard to marine engineering, together with the progress of sounder views as to the proportions of ...ge, and the bulk of the engine. The loss of the President excited much notice in the early part of the year, but no injurious ...an steam navigation has resulted from that casualty. The West India Mail Steamers have been completed, and steam ...een extended to theHavannah, to the Upper Elbe, and in Australia. Ocean steam towing has been tried in the Straits ... war with China has afforded full opportunity for testing the iron war steamers, and proving their value, and the steam ... increased.

...duced in Sydney, a prelude to its extension in the Australian Continent.

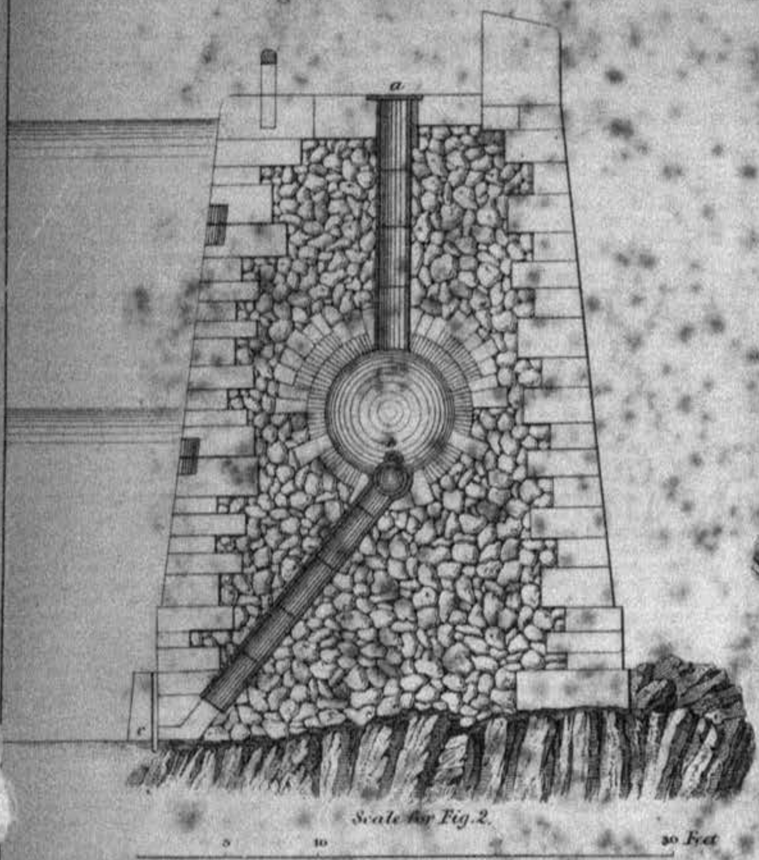
...ring has found much employment; although the depression of trade has prevented the erection of new factories, ...port trade has continued to increase. Turkey and many other countries have availed themselves of the skill of our ...s.

PORT OF ST MALO.

PLATE 1

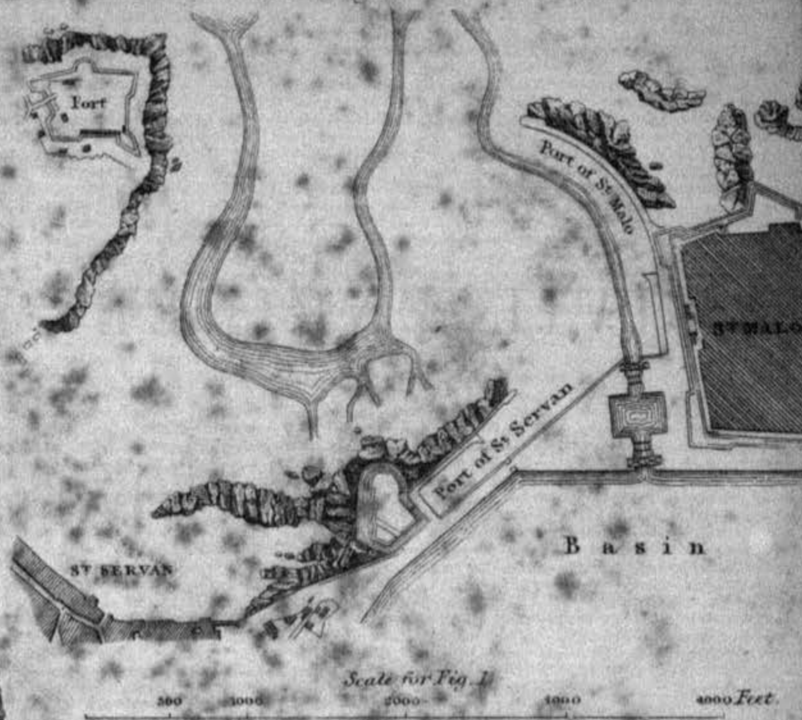
Transverse Section

Fig. 2



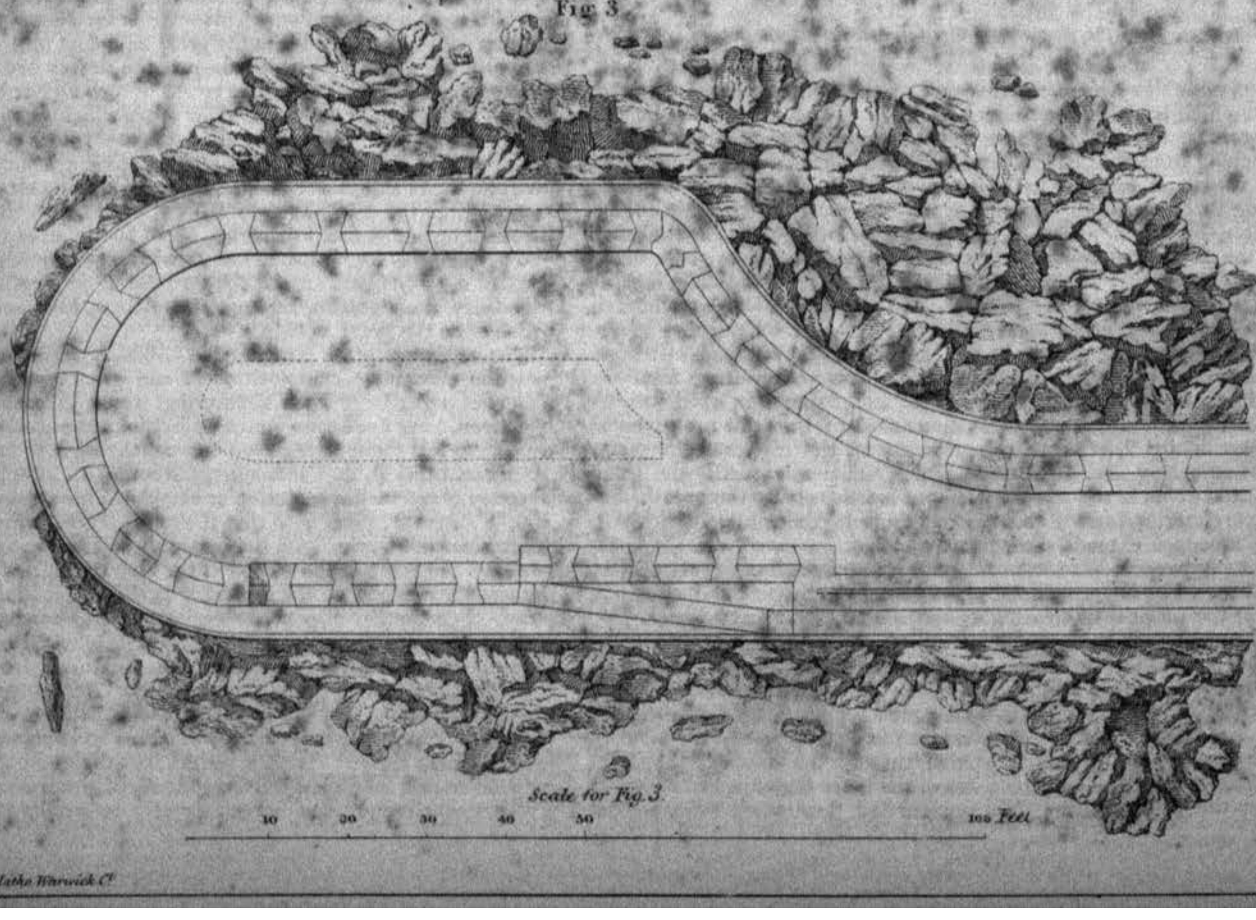
Plan of the Port of St. Malo and St. Servan

Fig. 1



Plan of the Port of St. Malo

Fig. 3



Jobbins Draftˢ & Lithˢ Warwick Cᵗ

THE

CIVIL ENGINEER AND ARCHITECT'S

JOURNAL.

ON THE CONSTRUCTION OF THE MOLE DES NOIRES, WHICH SHELTERS THE FRONT HARBOUR AND ENTRANCE OF THE GATES OF ST. MALO.

(WITH AN ENGRAVING, PLATE I.)

(Translated from the French of M. Girard de Caudemberg, Engineer-in-Chief of Roads and Bridges.)

THE Mole des Noires, forming part of the general plan of a floating basin which is to be common to St. Malo and St. Servan, has been in progress for the last two years, and is situated as pointed out in fig. 1, stretching from A to B. When the wind bows from S.W. to N.W., it is very much exposed to the action of the sea, and was consequently during its construction exposed to all the most unfavourable contingencies, by which works in direct contact with the sea are affected. For the purpose of opposing this action, a form has been given to the mole of an arc of a circle of 695 feet (212 met.) radius. The breadth of the top, including the parapet, is 19 feet (5·80 met.), which is strictly necessary for preserving a free passage for warping to the upper part, and for giving to the works the stability and resistance necessary to support the difference of pressure resulting from the maximum of the simultaneous elevation and depression of the waves on the two opposite faces. The dimensions of the mole are given in the section, fig. 2, in which are also shown the high and low water marks at spring and neap tides, which sufficiently justify the great elevation given to the work. This section also shows the great aqueduct or interior tunnel, and of the channels communicating with it. The aqueduct extends the whole length of the mole up to the head, and the upper and lower channels or pipes are made at every 65 feet distance. The lower inclined pipes end in a number of sluices, which are for the purpose of clearing away the silt in the front harbour.

The opinion of M. de Caudemberg was that this silt was little to be feared, but as the commissioners appointed by the Minister of Marine, insisted upon having an aqueduct which could work the sluices, in the front harbour, M. de Caudemberg suggested the plan now in execution. The aqueduct is 1978 feet (603 met.) in length and 7 feet 2 inches (2·20 met.) diameter, and is carried through the mass of the quay of the front harbour, crosses the gates of the inner harbour, and takes its rise in the floating basin. It is constructed throughout of an annular form. The pipes carrying the water to the sluices are inclined as represented in the section, and are of cast iron, their inner diameter is about 16 inches (0·40 met.), and the different parts which compose them are secured by a simple joint with resinous mastic. The upper part is terminated by a hemispherical cup 18 inches diameter, with a ball acting as a bomb valve. This valve is for the purpose of preventing the water introduced into the great aqueduct returning back again when the tide falls. Where however the sluices are intended to be worked the valve is lifted up, by means of a chain communicating with the upper surface of the quay. The water which flows from the aqueduct, through the inclined pipes, with the velocity of a column of water 24 feet high is carried through an opening 3 feet 3 inches broad, and of a mean height of 5 inches, so as to cause a stream of water to sweep away the silt. It should be observed that the large vertical pipes 19 inches (½ met.) diameter, serve for the evacuation of the air, and as manholes for cleansing and repairing the aqueduct. The parts marked *a b c* in fig. 2, are for the purpose of preventing the water at high tides from getting through the sluices, and causing an inverse pressure on the great aqueduct.

The engineer found considerable difficulty while constructing the mole, on account of the position of the great aqueduct, which as it was necessarily built upon a centering, would in case of wood being employed, have been soon blown up by the waves and destroyed, or at least have had the mortar forced out and the work to begin over again. To prevent this M. de Caudemberg directed his attention to the construction of a peculiar centering or shield. This centering was of cast iron, in moveable pieces, so that it should be readily managed in the progress of the works. On the outside was fixed an arm to break the power of the wave at the period of the shock, while at the same time the specific weight of the centering prevented it from being carried away. It is formed of panels weighing about a hundred weight each, so that they could be easily moved. The whole shield was 26 feet (8 met.) long, and divided into 16 rings.

M. De Caudemberg found that though by these means he broke the shock of the wave, that the works were still liable to suffer on account of the oscillations, particularly when the weather was rough, when masses of compressed air were forced into the great aqueduct, and so up the vertical manholes, causing spouts of water 30 or 40 feet high. These manholes however served greatly to modify the effects. As,

the best remedy, and one which was found effectual, the pannels of the centering were covered with sheet iron, pierced with holes so as still further to break the violence of the shock.

As however the cast iron centering was in some degree an impediment to the works, whenever the state of the weather permitted it, a wooden shield was used also moveable, so that keeping 6 feet and a half of iron centering outside, about 50 feet of wood centering was used behind it. In this way 50 or 60 feet in length was got through in a day. To get over the difficulties and expense of transporting the materials to such a narrow space, small lighters, flat bottomed boats, and floating platforms were used, which were found to act well, although some inconvenience was felt in rough weather.

ON THE CONSTRUCTION OF A PIER IN THE RIVER AGLY.

(Translated from the French of M. Fauvelle, for the C. E. & A. Journal.)

M. FAUVELLE describes a process which is extensively used in Roussillon for constructing wells, and has also been applied by Mr. Brunel on a large scale in making the descending shafts of the Thames Tunnel. In most parts of Roussillon, and particularly on the shores of the sea, and near ponds, at a yard or two below the surface, a layer of quicksand is met with, which cannot be dug twenty inches deep without the sand falling and filling up the excavation. This consequently prevents the usual course of digging a well and building the brickwork afterwards, as it would cost more in timbering and framework than the whole well was worth. A stout circular oaken curb is therefore placed on the ground, the walls of the well are built several yards high upon it, and then from the inside the shifting soil is excavating so that the well is carried down to the required depth. M. Fauvelle had to build the pier of a bridge in the bed of the river Agly on a bed, which although it seemed quite dry, yet filtered a great quantity of water through pebbles and sand for yards thick, these again resting on a bed of clay. Being prevented from want of funds from using the ordinary means of getting rid of the water, M. Fauvelle availed himself of the Roussillonese plan. On the bank he placed an oaken frame or curb, and on this he built a well or circular tower of brick, 16 inches thick, 70 feet in circumference, and 13 feet high. This well was secured internally so as to resist the external and vertical pressure. Excavations were then begun in the interior of the well, but some injury was done to the walls at first by the workmen digging under the curb, and so causing an unequal descent and cracking of the bricks. The works were then limited to the interior of the well, and it gradually descended until it became necessary to use the dredge, by means of which, in about a fortnight, it was got down into the clay bed without any accident or injury to the walls. Nothing then remained but to fill up the interior so as to make a solid mass, which was done, without taking out the water, by throwing in concrete and stones, this work being secured to the walls by their being roughed with a chisel worked by a long iron bar; the whole was then well rammed down by two men so as to make a solid mass.

CANDIDUS'S NOTE-BOOK.

FASCICULUS XXII.

"I must have liberty
Withal, as large a charter as the winds,
To blow on whom I please."

I. "ARCHITECTURE," says a writer in the last number of the Monthly Review, "is under a certain degree of restraint in every state of society. The nature of his materials, and the necessity of clipping down his conceptions to the views and wants of his employer, have accustomed the architect to act with apparent freedom, under circumstances which would wholly repress the ardour of the sculptor or the painter." This is rather oddly expressed, it being not very much unlike a contradiction in terms to attribute *freedom*, or apparent freedom, on the part of architects, to the *restraint* imposed upon their art. The writer does not seem to have taken the trouble of reading over what he had put down upon paper; but his meaning probably is, that the necessity of clipping down his conceptions, &c., has accustomed the architect to act with a servile compliance—a blind deference, to the wishes of his employers, and to do just as he is dictated to do, as if it were perfect matter of indifference to him; whereas a sculptor or painter is not quite so docile, but less patient of impertinent interference, and is apt to prove restive on such occasions, or else gets sulky, and pretends that he can do nothing if not allowed to have his own way. This, I conceive, would be much nearer the truth; for I do not understand how the architect can be said to act with apparent freedom, when, however willingly he may do so, making a virtue of necessity, he is evidently acting under control, and obliged to forego his own ideas, and maim his design by adopting those of other people.

II. There is, I suspect, no small share of hypocrisy, and not a little cowardice, also, with some addition of affectation into the bargain, in the praises heaped upon Palladio, because I have never yet either met with books, or been able to gather from any one in conversation, in which of his works the merits so liberally ascribed to him really consist. In speaking of him, every one seems to think it the safest policy to confine himself to general eulogy, without venturing at all into particulars. Nay, I have met with those who, after surrendering up to criticism, one by one, every production of his mentioned, have not had *courage* enough to confess that they were advocating a losing cause, but give themselves the airs of having the better of the argument, because, forsooth, Palladio had always been considered a very genius in architecture.

III. It is not without reason that Klenze has lately animadverted upon the plodding, barren, "machine-like," manner in which modern architects have applied themselves to Grecian architecture, without getting a step beyond two or three very obvious and stale ideas, which have now been hackneyed *ad nauseam*; as if its elements could not, by any possibility, be made to furnish fresh combinations or farther modifications as to detail, but every thing must be most according to precedent, at least, as far as columns alone are concerned, since, in regard to all the rest, a most convenient degree of latitude is considered quite allowable. It must not, however, be supposed that such "machine-like" system, one so utterly at variance with every principle of art, would be upheld in the manner it has been and continues to be, without some motive, although it is one which it would not do to let all the world know. The excessive reverence affected to be entertained by the *plodders* for antique examples, evidently does not proceed from an intelligent admiration of them; for it is plainly to be perceived that they have no influence whatever on their taste, and that if such admirers have studied them at all, it has been no otherwise than mechanically, without imbibing any of their spirit, without extracting from them any of their delicious flavour, after the fashion of that most praiseworthy little plagiarist, the bee, who steals their sweetness from flowers, but manufactures it into the still more luscious sweetness of honey. The dunces in the profession—and if any one chooses to include himself among the number, it is no fault of mine—the dunces, I say, are well aware that it is good policy in them to decry any modification of the antique, any thing like originality in the treatment of it, as most dangerous and mischievous innovation. Mischievous, indeed! no doubt—because were any sort of freedom in that respect to be allowed, were the system of copying and nothing but copying, to be exploded, as not exactly in character with what, justly or not, assumes to be something more than a mechanical science, even one of the fine arts,—the incompetence of many would at once become apparent, they being, as Wightwick has wickedly observed, "impotent to generate" even a single modification of what they now so *classically* follow as patterns; much more, then, to generate an idea of their own.

IV. It is by no means uncommon to hear people complain how exceedingly difficult it is to hit upon any new subject; nevertheless, there are both a good many hackneyed ones, which would admit of being treated with some degree of novelty, by blowing away the *learned* dust which now almost covers them, and freshening them up anew; and also a few others that have as yet not been touched upon at all, notwithstanding that they would furnish matter almost inexhaustible, and the opening of them would be like opening a virgin mine of unexplored wealth. It is odd that, until the other day, no one should have thought of treating the subject of porticoes as is done in the article in the Penny Cyclopædia, which, although unsatisfactory, because little more than a brief outline of it, is most valuable as a hint, and as pointing out what preceding writers had overlooked. I, myself, have at least half a dozen architectural subjects *in petto*, any one of which would supply matter for a volume, and some one of which I have long been expecting to see pounced upon and taken up by some less indolent or more enterprizing mortal. Nevertheless, they still all remain untouched, as safe and as snug as if they were buried within the innermost bowels of the earth, though really exposed where any one who has eyes to see with may behold them. There is plenty of fresh game to start, had but people noses to catch scent of

it; for instance ——————, and ——————, and ——————, I leave it to the reader's penetration to fill up the blanks,—all choice and fertile subjects as well as new, and only waiting for some one to pick them up; though I fancy that were they to stumble against them, most people would only stumble over them. It is undoubtedly very fine to be eternally talking about "Pericles," and such very *sublime* matters; yet that is not the way to discover any thing particularly novel. Those who walk abroad star-gazing, do not notice a purse of gold under their feet, or should they chance to tread upon it, only kick it away from them as a mere stone in their path.

V. The author of the "Palace of Architecture" has, I see, thought it necessary to assure the readers of Fraser's Magazine, that the article entitled "Wightwickism," in that periodical, was not a slashing cut-up of his book, as some of his own friends had conceived it to be, and were accordingly very indignant that such a violent attack upon it—nothing less than a downright demolisher—should have proceeded from that quarter; nor are they the only persons who have taken up that singular idea, for some sapient newspaper critic has described the paper alluded to as a complete settler for Wightwick! It is charitable, therefore, to suppose that both the reviewer alluded to, and those who have fallen into the same error, read no more than the first page or two of the article, otherwise they must be obtuse and obfuscated indeed, not to perceive its real drift. But there are people in the world so dully matter-of-fact, as to have no notion whatever of either irony or humour—people who take such a pleasantry as "A Lesson in Reviewing" for a serious attack upon Mr. William Cowper, the poet, fancying the writer to be in earnest when he gravely censures the bard's indelicacy, or rather offensive grossness, in venturing to use the term breeches, instead of employing the long-winded circumlocution resorted to by his biographer, Dr. Southey, in order to express, or rather insinuate the idea of, that vulgar article of male attire. And there are folks, it now appears, who either are, or affect to be, so perversely thick-headed as altogether to misconceive the writer's object in "Wightwickism." Nevertheless, with such exquisite stupidity staring us in the face, the present age is styled that of the March of Intellect—which "March," is, perhaps, the gravest and most notable mystification of all.

ON LIMES.

RESEARCHES ON THE SEVERAL PROPERTIES WHICH MAY BE COMMUNICATED TO CEMENT STONES AND HYDRAULIC LIMES, BY IMPERFECT BURNING. By M. N. VICAT.

(Translated for the C. E. and A. Journal.)

The principal object of this treatise is to illustrate several singular properties of imperfectly burned argilo-calcareous substances, and also some anomalous cases with regard to hydraulic limes. It is well known that hydraulic limes are converted into cements, when the proportion of clay is increased beyond a certain limit, in which transition may be recognised the nature of those compounds which participating in the properties, both of limes and cements, belong to neither class. Those compounds, which the author denominates *chaux limites*, or intermediate limes, on being completely burned, (that is, entirely deprived of carbonic acid), and treated like cements, become absolute cements, but if the cohesion be instantaneously acquired, it is lost in a few hours by a gradual extinction of the cementing properties, which instead of producing hydraulic lime, leave nothing but a kind of caput mortuum. Common hydraulic limestones have also peculiarities, becoming good cements, or giving products almost without value, according as they are burned to a greater or less degree.

The confusion resulting from such apparent inconsistencies, and the serious difficulties which had occurred in carrying on several important works, induced M. Vicat to investigate the subject, and to present the following observations as the result of his inquiries.

1st. All limestones containing 53 per cent. of clay should be rejected as extremely dangerous, and never allowed to be used in any operation, being incapable of forming any useful cement.

2nd. Perfect imitation of hydraulic limes by the mixture of slack lime and cement is impossible; as these mixtures are but slightly hydraulic, therefore to imitate natural hydraulic limes, the regular process must be followed.

3rd. Every argilo-calcareous substance, capable of producing a cement after being thoroughly burned, also gives a cement on being imperfectly burned, provided that the proportion of clay to free lime in the rough stone, does not exceed 273 per cent., or in other words, provided that there are less than 273 parts of clay for every hundred of lime. In acting upon this rule, super calcination is the only thing to be guarded against.

4th. Every argilo-calcareous substance, capable of producing an *intermediate* or hydraulic lime by being thoroughly burned, can on being imperfectly burned, produce a cement, or at least a product having all the properties of one, provided that the proportion of clay to free lime in the rough stone is not below 62 per cent., not only the imperfectly burned stones are no longer cements, but they may even fall into the class of weak hydraulic limes with a gradual extinction of power. As therefore no practical means exists of distinguishing at first sight imperfectly burned cements from those which are burned, and still less of regulating the degree of heat, so as to expel uniformly the required proportion of carbonic acid, it follows that by pulverising imperfectly burned cements, and mixing them indiscriminately with mortar as has been done on several works, the mortar instead of being improved, has had introduced into it an element of destruction.

Lastly. The manufacture of cement from intermediate limes is attended with serious difficulties, as it is impossible to find out which are perfectly burned. Every assay for the purpose of testing the quality of hydraulic lime, should be preceded by experiments on the quantity of carbonic acid contained in the lime, for if this acid is present in such a proportion as to show imperfectly burned non-cement, the assay will point out as bad an hydraulic lime, which thoroughly burned, would have the required qualities.

To the presence of imperfectly burned cements, M. Vicat attributes most of the injuries, splitting of joints, &c., visible in buildings, and which never occur when the lime is good. As the quickest and surest test M. Vicat recommends chemical analysis, but disapproves of the ordinary mode, for if the clay be separated from the carbonate by an acid and then treated with potass, a gelatinous silex is produced from those quartrose particles which do not enter into combination. He therefore recommends the immediate reduction of a few finely powdered grains into lime or cement; to make sure that no carbonic acid remains, and to dissolve the whole in an excess of hydrochlaric acid. The residue, not reduced, will give the quantity of uncombined clay which imbibes the hydraulicity of the lime. The rest of the assay may proceed in the usual way.

OPENING OF THE PORT OF FLEETWOOD-ON-WYRE TO NIGHT NAVIGATION.

THIS interesting and important event took place on the evening of the 1st of December. It must ever be interesting to behold the efforts of art founded on pure science, when supported by spirited funds, eminently successful. It must ever be appreciated as a vital achievement when a region, hitherto unapproachable by night and seldom by day in stormy weather or slanting winds, shall be pronounced and proved, not only accessible, but within the instant comprehension of the weather-driven mariner, even though he never saw the coast before. Such have resulted at Fleetwood-on-Wyre, under the plans and personal superintendence of Capt. Henry Mangles Denham, R.N., F.R.S., consulting marine surveyor, supported by the encouraging confidence of the board of directors, and unflinching appropriation of means. It is our pleasing task to record facts so honourable and gratulatory to all parties engaged. Here is a Company realising all that is due to energetic espousal of capabilities which might as heretofore, have laid useless to a nation, and unprofitable to enterprise, but for the exercise of perception and that moral courage which boldly traces in perspective reasonable results. An estuary hitherto (indeed 16 months ago) overlapped by spits in its seaward reach, precluding intercourse with its natural tidal basin and anchorage, now presents a straight course, of but 15 minutes run, between 20 fathoms Irish Sea water and the railway terminus, which is connected by 11 hour, journey with London. The full particulars of which are set forth and illustrated in Capt. Denham's work on the Mersey, Dee, and Wyre navigation. We, therefore, need only revert to it, and glance at the simple, but effective ceremony which locally marked the occasion of formally opening the Port. At sunset on the evening of the 1st December, the Chairman, Sir Hesketh Fleetwood, Bart., M.P., a party of 80 gentlemen, their Secretary, John Power, Esq., and last, but not least, some fair ladies, accompanied Captain Denham in a steamer to the offing. Passing the several buoys which mark the New Cut channel, for daylight and hazy weather guidance—at a proper period of darkness, when no vestige or clue to land, or haven entrance, could be traced, and no access to be hoped for until the next morning, a rocket was thrown by Capt. Denham, and instantly the lantern chambers of the new light-houses were unmasked. Three hearty cheers welcomed the lights on board, and three more with every hand open, greeted Captain Denham; whilst peals of cannon on shore called attention to the fact. The lights were then brought in line, the course shaped, and at a nine knot rate the party were, in fifteen minutes alongside the Railway wharf. The instant of clearing the New Cut was signalled by a shower of rockets from on board. Cheer after cheer was responded to on shore by guns, rockets, and cheers; whilst the bands sent forth our glorious national anthem and Rule Britannia. Truth and candour avowed itself where 'tis ever nurtured. One of the ladies exclaimed, to the delight of the gallant Captain,—"Why the process of coming into this port is so simple, *I* could bring a vessel in."—*Railway Magazine.*

WHITELAW AND STIRRAT'S PATENT WATER MILL.*

Fig. 1

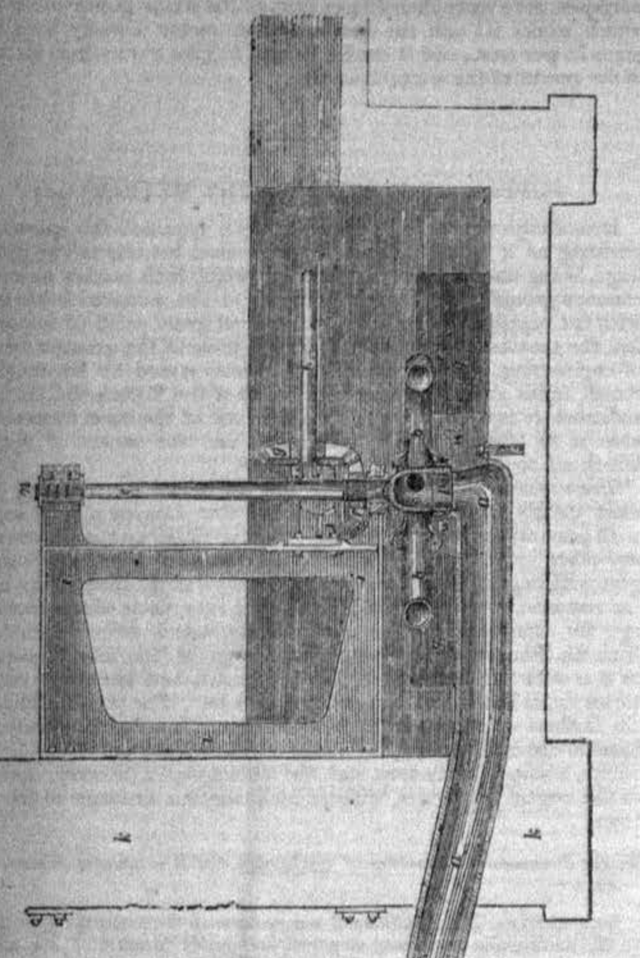
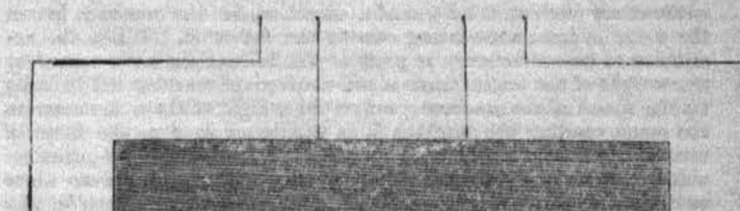


Fig. 1 is a side elevation of the new water-mill, in which [figure some of the parts are drawn in section. Fig. 2 is a plan showing the arms and other parts of the machine. The main pipe *a a* carries the water which drives the machine into its arms, from a reservoir or any suitable place on a higher level than the arms; *b b* are the arms, which are hollow; the water passes into them at the centre part *c*, and escapes out at the jet-pipes *d d*; *e e* is the main or driving shaft of the machine, which is shown cast in one piece with the arms; *f* is a bevel pinion, and *g* a bevel wheel; by means of which wheel and pinion the rotary motion of the machine is communicated to the horizontal shaft *h*, which again communicates the power of the machine to any machinery which it may be intended to work; *i i i* is a large bracket fixed to the wall or building *k k*; this bracket supports the shaft *e e*, while the bracket *l* carries one end of the shaft *h*. The perpendicular plane which passes through the parts represented in section in the elevation, Fig. 1, passes through the points *m m* in the plan, Fig. 2. The top journal or bearing *n* of the main shaft has a number of collars on it; for, if there were but one collar, it would require to be made larger in diameter than the collars shown in Fig. 1, in order to get a sufficient quantity of bearing surface; but if the diameter of a collar be increased, the friction will be greater, as then the rubbing surface is more distant from the centre of motion; so, if a sufficient quantity of bearing surface is obtained by a number of collars, there will be less friction than if only one is used to resist the pressure. *q q* are holes through which the water escapes from the basin under the arms into the tailrace after it has left the machine. As the arms have a rotary motion, and the pipe *a a* is fixed to the building under it, there must be means provided to prevent the escape of water at the place where the main-pipe meets the arms. A contrivance suitable for this purpose is shown in Fig. 1; it consists of a ring or projection round the underside of the aperture *c*, and of a part *p* turned cylindrical at the place where it fits into the pipe *a a*. A leather, similar to what is used in packing the large piston in a Bramah press, is inserted into the recess *w w*, turned inside of the top part of the pipe *a a*, in order to prevent the escape of water betwixt the pipe and the cylindrical part of *p*. It will now be clear that if the part *p*, and the ring on the underside of *c*, are accurately turned and ground upon each other at the place where they meet, the pressure of the water in the main pipe will act upon the under edge of *p*, and press it in contact with the projecting part round the aperture *c*, and in this way keep the joining of those parts water-tight. There is a flanch outside of *p*, with holes bored in it, to receive steadying-pins fixed to the top part of the pipe *a a*; these pins are seen in Fig. 1; they prevent the part *p* from revolving, and are fitted so as to allow *p* to rise or fall. There is another use for the flanch round *p*, which is this:—a little rope-yarn is wrapped betwixt it and the main pipe, to prevent the part *p* from sliding down whenever there is not a sufficient pressure of water in the main pipe to support it. The pipe *a a* is bored out to receive the part *p*, which is fitted so as that it will slide easily up or down in the bored part; *r r r r* are the stay-bolts which support the arms; *s s* are valves, and *s t s t* are levers which work upon the centres *t t*, and form a connexion of these centres with the valves. There is a lever on the top, and one on the bottom side of each valve. The rods *u u* form a connexion with the levers *s t s t*, and the springs *v v v v*, fixed to the arms. The end next the valve of each jet-pipe (see Fig. 2) is a circle drawn from *t* as a centre; and each valve is curved

Fig 2



to fit and work correctly upon the end of its pipe. The levers *s t s t* are adjusted so that the valves *s s* will work without rubbing upon the ends of the jet-pipes, in order to get quit of the friction as much as possible; but it is not essential that the valves should be correctly water-tight. It will be clear, that if the machine revolves so fast as to make the united centrifugal forces of the valves *s s*, the rods *u u*, the levers *s t s t*, and the springs, greater than the weight that will bend the springs *v v v v* to the distance shown in Fig. 2, the valves will recede from the centre of the machine till the force of the springs gets sufficient to overcome the centrifugal force of the valves, &c. Therefore, the centrifugal force will cause the valves to cover the ends of the jet-pipes, and so allow less water to escape, and thus diminish the force of the water on the machine whenever it goes quicker than the proper speed. If the springs are considerably bent

* We are indebted for this description to a pamphlet by James Whitelaw, and for the use of the wood engravings to the Editor of the Mechanics' Magazine.

or strained when the valves are full open, a very small increase of the speed of the machine will cause the valves completely to cover the ends of the jet-pipes, and when the ends of these pipes are closed, the water can have no power to turn the machine. From this it will be clear, that the machine can be made so that, when it is doing very little work, it will not move at a much greater speed than it will when acting with its greatest power.

The new water-mill acts on a principle similar to that of the well-known Barker's mill; but the arms are bent and otherwise shaped, so as to allow the water to run from the centre to the extremity of the arms when they are in motion, in a straight line, or nearly so, and in this way the disadvantages of carrying the water round with the arms, as is the case in Barker's mill, are got rid of.

The curve of the arms is such as to allow the water to run from their centres out of the jet-pipes, without being carried round by the machine, when it is in motion at its best speed. On this account, the rotary motion of the arms will not give to the water a centrifugal force. So the forces which work the new water-mill are simply the force of reaction, and the weight of a column of water of the same height as that acting on the mill, having the area of its cross section equal to the sum of the cross-sectional area of each jet-pipe. When the machine is standing, the one of these forces is as great as the other; but when it revolves so quick that the centres of the jet-pipes move at the same speed as that of the water flowing from them, the force of reaction ceases, as then the water falls from the jet-pipes without any motion, in a horizontal direction, for the machine leaves the water as fast as the acting column can follow it. When the resistance to be overcome is as great as will balance the force caused by the weight of the water, there is still the force of reaction left to bring up the speed of the machine; and as the weight of the water remains the same, whether the machine is in motion or at rest, the force of reaction will carry up the speed till the centres of the jet-pipes revolve at a velocity the same as that of the water issuing from them before it ceases. Thus the machine, when its jet-pipes revolve at a speed as great as that of the water issuing from them, will give its maximum of effect, which maximum will be equal to the whole power of the water it uses; for, in the time a given weight of water is expended, in the same time the machine is able to raise as great a weight from the level of the centres of the jet-pipes to the level of the surface of the water in the lead. There is of course a small part of the power lost, most of which is that caused by the resistance which the water meets with in passing through the main pipe and the machine. This portion of the force is very inconsiderable, as will be shown in the next paragraph; and, by making a slight alteration on some parts of the machine, this small fraction of loss may be still farther diminished.

A machine erected lately for Messrs. Neill, Fleming, and Reid, at their works, Shaws-water, Greenock, gives, when tested by the friction apparatus invented by M. Prony, 75 per cent. of the whole power of the water which works it. The power of the water is 79 horses, and the power of the machine is equal to that of 59·25 horses or 75 per cent. as now stated. Mr. Stirrat's water-mill of 2¼ horses' power is the first that was made; it was tested in the same way as the above-mentioned machine, and the result of the experiment was equally favourable.

The following are some of the advantages which the hydraulic machine of Messrs. Whitelaw and Stirrat, has over an overshot water-wheel of the best construction. The new mill has a governing apparatus, which renders its motion as uniform as that of the best constructed steam-engine; when a part, or even the whole, of the machinery which it works, is thrown off at once, the variation in the speed is scarcely perceptible. The speed of the new machine is well suited for every purpose: generally speaking, it can be formed to make the required number of turns in a given time, and on this account, intermediate gearing is done away with. There is little wear and tear on the parts of the new mill, for its weight is perfectly balanced by that of the water, thus taking away almost all friction, and consequently wear, at the rubbing parts: five of these machines are already in operation, and not a workman has been employed in any way at either of them since they were first set a-going, although one has been in constant use for nearly two years. The new machine takes up remarkably little room. No very expensive building or other erection is needed for the fixing of the new water-mill, and the cost of the machine itself is very trifling in every case, and especially on a high fall, where an overshot wheel, as also the building and excavation required for it, become enormously expensive. On a fall of very great height, where to erect an ordinary water-wheel would be altogether out of the question, the new water-wheel may be employed to great advantage. The new machine may easily be made to rise or fall according as the water in the tail-race is high or low, and one form of it will work to very considerable advantage in tail-water. The best constructed overshot water-wheel will not, after the speed is brought up for ordinary purposes, give more than 70 per cent. of the whole power of the water which works it; and the new machine, as has already been shown, gives 75 per cent., and it can be formed to give even a greater portion of the power of the water than this.

SUPPLY OF WATER TO THE METROPOLIS.

It is always with much pleasure that we approach this question, interesting as it is not only to the profession, but also to the public at large, being one of those subjects on which both parties meet as on common ground. The supply of water to the population has always with the supply of food generally acquired great political importance, and the provision for it has called forth some of the greatest triumphs of engineering. It has been but too truly stated by Dr. Southwood Smith, in his able Reports on the Health of the Metropolis, that an insufficient or impure supply of water is one of the main causes of disease in all classes of the community, and the means of removing which are well known to be in existence.

The valuable report which we now lay before our readers, proves most clearly to every unbiassed mind that London may be supplied with pure water without having recourse either to the Thames, or to any other river. All rivers and open canals are infected in some degree with vegetable and animal matter, particularly after heavy rains—for instance, even the New River is the receptacle of the land drainage for many miles. The water-works which derive their supply from the Thames are all within the range of the tide, impregnated as it is with the drainage of the metropolis, and the large manufactories on its banks, and so must it always be. The works which stand the farthest up the river, those of the Grand Junction Company at the London end of Brentford, are within the immediate vicinity of large gas works, a soap manufactory, and the drainage of a brewery, and of one of the largest distilleries, without reckoning the drainage of the whole town.

To the Provisional Committee of the London and Westminster Water-Works, &c. &c.

Gentlemen—The insufficiency and badness of the present supply of water to the metropolis have long engaged the public attention; but although many endeavours have been made to establish it on a better basis, owing to causes which we must seek in the elements of the projects themselves, they have invariably failed.

As it appears, however, generally admitted, that something should be done, we are naturally led to inquire into the reasons of the want of success of former attempts, and by carefully avoiding these, and at the same time endeavouring to present an effective and practical remedy, we may still hope to deserve the public confidence. It will, therefore, be my endeavour to show, in the following report, that Nature has supplied us with the means of substituting a pure and unceasing flow of spring water for the outpourings of filthy drains, and that this can be done without encountering difficulties of any but an ordinary nature.

Nevertheless, before I proceed to do this, it may not be useless that I should briefly enumerate the various plans which have hitherto been suggested to attain this object; as this will at once prove how much time and attention, not only numerous private individuals, but even the legislature, have bestowed on the subject; and will also enable me to point out to you what appear to me to have been the causes of their rejection.

So far back as the year 1821, a committee of the House of Commons made a long report, in which they recommended that a bill should be passed to regulate the water companies, which had at that time caused much dissatisfaction, on account of the great increase, which a coalition enabled them to make, on their former rates. The inquiry, although it does not appear to have led to any positive result, nevertheless, called the attention of the public to various facts which were not previously generally known, and among others, to the very inferior quality of water which many of the companies supplied. We accordingly find, that in 1824, a highly respectable body of gentlemen held a meeting, to take into consideration a proposition of Mr. Philip Taylor's, to conduct the water of the Thames, by means of a subterraneous aqueduct, from a point near Richmond, to reservoirs at Kensal Green and Hampstead Heath.

In 1825, a company was formed to supply the metropolis with spring water, from beneath the London clay, a project which was again brought forward in 1835, and to which I shall have occasion, in a later period of this Report, to allude at some length.

But it was not until the spring of 1827 that in consequence of the publication of a pamphlet, entitled "The Dolphin," by Mr. Wright, the general mass of the inhabitants of London could be said to have been aroused to a sense of the paramount importance of a better supply of water to their houses, than that derived from some of the most foul portions of the river Thames. Al-

though deferred for such a length of time, the public indignation now became unanimous, and at a meeting held in April 1827, which was attended by a most influential body of the nobility and residents of the West of London, resolutions of a very strong nature were passed, and a petition agreed to, praying for the appointment, by the Crown, of a commission to inquire into the present modes of supply, and their effect on the health of the population.

In compliance with this urgent demand, Dr. Roget, Mr. Brand, and Mr. Telford were named on the 12th July, 1827, to examine the allegations brought forward, which at once led to the suggestion of numerous remedies, for an evil, which no one appeared ready to controvert.

Among these we find a Mr. Hipkins proposing to convey in an open conduit, the water of the Thames, from above Old Brentford. Dr. Kerrison, from Isleworth, and Mr. James Mills, from Teddington; Mr. Martin, the artist, also sought to shew that the water of the river Colne might be brought in a canal from Denham, in the neighbourhood of Uxbridge, to London; and, in addition to these, various other proposals emanated from Messrs. Smart, Brown of Wakefield, Chambers, Jones, William Anderson, &c. &c.

None of these, however, were fully discussed by the commission, as the demand for their Report rendered it necessary that it should be given in long before they could well said to have terminated their labours.

The evidence they obtained enabled them, however, to decide "that the present state of the supply of water requires improvement, that the complaints respecting the quality are well founded, and that the water ought to be derived from other sources than those now resorted to."

In consequence of this report it was deemed necessary that a Select Committee of the House of Commons should be appointed to make further enquiries, and at the end of the session it appears to have fully agreed that the supply should be derived from a purer source than the present, in furtherance of which object it was recommended that Mr. Telford should be employed to make such surveys as would enable him to suggest a practicable plan of supplying every part of London with wholesome and pure water. After several years of protracted enquiry, Mr. Telford came to the conclusion that it would be desirable to bring the water from the river Verulam, on the north side of the Thames, and one of the branches of the Wandle, on the south, to London, to effect which so large an outlay was necessary, that he proposed it should be met by a parliamentary grant.

Another and numerous committee of the House of Commons again met to consider these plans, but its labours were unfortunately not terminated at the end of the session: the enquiry may therefore still be considered as remaining nearly in the same state in which it was left in the year 1834.

The plan of sinking Artesian wells to the sands of the plastic clay or chalk, has indeed, as I have already mentioned, been again mooted, but abandoned for causes to be hereafter detailed; and Mr. Telford's proposal of bringing the water of the Verulam to London has also been taken up, with various modifications, by Mr. Giles, who, however, did not succeed, I believe, in the preliminary step of finding capitalists willing to embark in the undertaking.

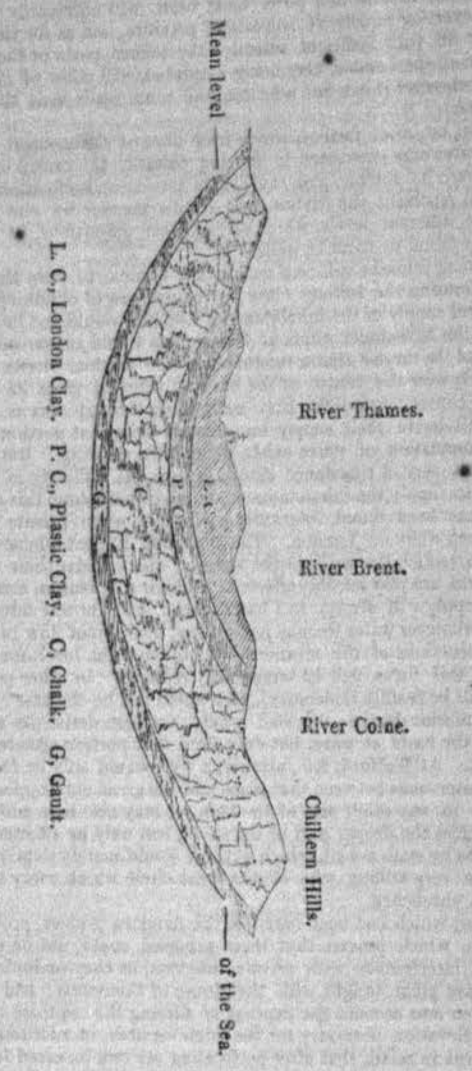
It will now, I think, be sufficiently established that the present mode of supplying London with water, has for a length of time, been any thing but satisfactory to the public; and if for some years past the subject has been allowed to rest, it has probably arisen more from a prevalent idea that the enquiry was in the hands of the legislature than from any real abatement of the grounds of complaint.

From various causes it would seem, however, that there is no intention on the part of tha government to prosecute the enquiry; and, indeed, this may in some degree be accounted for from the country being called upon, according to Mr. Telford's plan, to expend nearly £1,200,000 to carry that into effect which many have already doubtless perceived to be but a partial remedy for the evil.

It is indeed surprising, that with the exception of the proposal to obtain the water by perforating the London clay, every project, including Mr. Telford's, should have contemplated using the water of streams which are all subject to be affected by the surface drainage of a more or less extensive tract of country, and, consequently, only a very few degrees better than that already in use, whilst at the same time all the difficulties consequent on the injury to existing interests, as navigations, mills, &c. have to be encountered. Many, although they sought to remove the objection to using the water of the Thames in the immediate vicinity of London, continued to endeavour to derive their supply from a greater distance, where, although, certainly less liable to contamination, it might still be considered as the common sewer of many important towns on its banks, and the general drain into which much animal and vegetable matter must find its way, particularly after the scouring of the neighbouring country by every heavy fall of rain.

I do not, indeed, at all contest that the extraneous bodies, which pollute the water of rivers, are merely held in mechanical suspension, and that provided we get rid of these by allowing them to fall to the bottom, the Thames water may be looked upon as quite as pure as any other. But there appears to me one material objection to the method of removing the impurities by rest, which applies to all surface water, namely, that a considerable space of time is necessary to admit of their complete separation, and as this is also increased by the slightest agitation again diffusing the particles of the deposit through the water, the gradual accumulation of filth in the reservoirs, and the lapse of time requisite to render the water clear, must undoubtedly add to its unpleasant odour and flavour, or, in other words, to its tendency to become putrid. I therefore repeat, that it is scarcely to be wondered at, that the legislature should have delayed acting on Mr. Telford's plan, which combined these objections with a very large outlay, nor that a company should still have found grounds for proposing Artesian wells in preference to his suggestions. That this, however, was not to have been easily attained, appears partly proved by the fact, that this project was never brought to maturity, and the remarks I am now about to lay before you will also, I trust, confirm this view.

The group of strata, designated as the lower tertiary, or eocene, and consisting of two divisions, the upper called the London clay, and the lower composed of various coloured sands and argillaceous deposits, distinguished as the plastic clay, lying immediately upon the chalk formation, may in general terms be described as a huge mass of clay resting upon a still more extensive



bed of chalk. The section which accompanies this report, and which, with slight modifications, is taken from Dr. Buckland's Bridgewater Treatise, will shew this clearly, and by inspecting it you will at once understand that the surface of country occupied by the clay, is surrounded on all sides by a belt of chalk, excepting to the east, where the German Ocean for some distance interrupts the continuity, and you will also perceive that this cretaceous circle is, generally speaking, higher in level than the deposit of clay which fills the centre of the basin.

It is almost needless that I should inform you, that of the water which descends as dew or rain upon the surface of the London clay, little, if any, can be considered as absorbed into the earth, and that whilst a part either again reascends into the atmosphere as vapour, or enters into the composition of animal and vegetable bodies, by far the greater portion flows off into the main drain of the district, the river Thames.

In this respect there is a most material difference from that portion of the surface where the chalk comes to light, divested of any covering which could intercept the passage of the moisture; being not only extremely porous but also full of fissures in every direction, a very rapid absorption takes place, and we accordingly find that there are but few streams carrying off the surplus surface water, and that these are insignificant, and, indeed, many of them dry during the greater part of the year. The rapidity with which the water finds its way into the bowels of the earth, also in a great measure, prevents

evaporation, and we are therefore justified in assuming that the quantity which descends upon the surface of the chalk finds its way, with very slight diminution, into the fissures below. The lower beds of the cretaceous group, and the gault which immediately succeeds it, again present an impermeable stratum of clay, causing the water to accumulate through the lower regions of the more porous chalk. An enormous natural reservoir has thus been formed and the level up to which it may be considered as quite full of water is the lowest point where it can find a vent and overflow, therefore, as the chalk communicates under the coasts of Norfolk, Suffolk, and Essex with the ocean, this level, in the present case, may be considered to be the same as the mean height of the sea.

That there is, however, an extensive accumulation of water above this level will be obvious, when it is considered that the friction, which from the nature of the small fissures and pores must exist, will necessarily prevent the water from exerting rapidly its hydrostatic pressure, and as for this reason it cannot flow off with sufficient velocity, the higher parts of the chalk belt which surround the London clay being saturated, will allow of its escape to the surface wherever it can find a nearer and more ready vent than its subterranean one.

The greater or lesser facility, which from lines of fissures soft strata and pores, the water may encounter in flowing towards the centre of the basin, will also govern its surface, and cause it to assume an inclination, the angle of which will represent the friction, and in this manner we may readily account for the different levels, which often appear anomalous, at which the water will be found to stand in wells.

The foregoing remarks will now enable me, I think, to show that the proposal of perforating the tertiary clays for the purpose of obtaining the water for the general supply of the inhabitants of London, would not have been attended with the advantages which at first sight it would appear possessed of: it may indeed be urged that a reference to the section, shews us London situated nearly over the centre of the basin to which it gives its name, and that we may consequently infer, that wells sunk through eocene strata into the chalk, will derive their supply immediately from that portion where the greatest accumulation of water exists by my own shewing. But it will be found that this very circumstance throws a material difficulty in the way of any attempt to supply the inhabitants of the Metropolis from this source, and one which has been found frequently confirmed, when private individuals have sunk deep wells in London. The objection is, that whenever a large quantity is extracted, the wells in the vicinity, which derive their water from the same strata, are very sensibly affected; and, for this reason, that although a constant supply will always, as I have shown, find its way down, to take the place of whatever water we may pump away, this cannot flow in so quickly from the obstructions of the stratification, but that the level, for some distance round this focus, will be temporarily reduced. In other parts of the district, as will be readily understood, this would not be the case; or if so at least in an inferior degree, as a well would not here derive its share from every side of the basin at once, but only from that portion situated immediately above it. At Watford, for instance, a well would only be fed from the chalk which intervenes between that place and the great outcropping Chiltern ridge, and so in any other part of the belt. I may also here add, that the sheet of water in the deeper part of the chalk, can only be affected to an insensible degree by such a well, which at most would merely deprive it of the supply from a very trifling part of the great circle which every where else would remain untouched.

The company which had been based on the Artesian project, probably soon obtained facts which proved that their proposal could not be established without such interference with private interests, as they undoubtedly foresaw, would have great weight with the House of Commons; and they must also have taken into account the expense of forcing the requisite quantity of water to the elevation necessary for the high services, in addition to which, it must be borne in mind, that after perforating say two hundred feet of clay, the water under London by no means rises to the surface. As might have been readily foreseen, this idea was after some time, abandoned; and it is not surprising, that its originator, Mr. R. Paten, should have turned his attention to other endeavours.

The abundance of the springs which overflow into the Colne valley, above Watford, and the apparent purity of the water, had long attracted his attention, and now led him, in connexion with some other gentlemen, to make various experiments to ascertain whether a sufficient quantity for the demands of the Metropolis, could be obtained in that neighbourhood, at a small depth beneath the surface; and whether this might be effected without injuring the existing interests in the vicinity. When it was found that the result more than confirmed their most sanguine wishes, I was requested to examine whether the experiments were well grounded, and to advise as to the means of carrying the plan into effect.

I had for a length of time been acquainted with the various proposals which have been submitted to the public, and was aware of the objections which could with justice be urged against them. It was therefore not without pleasure that I undertook the examination of a plan, which I at once saw might be possessed of advantages, which were not before contemplated.

It will be my endeavour, in the remainder of this Report, to show how far the hope of obtaining the necessary quantity of water at Watford is well founded; to describe the experiments which have been made for the purpose of acquiring practical data, to explain the proposed method of procuring the water and conveying it to London; and lastly, to submit such remarks as will enable you, in my opinion, to present the project before parliament, with a confident reliance that it cannot but deserve its attention and support.

As I have already described at some length the geological features of the country surrounding London, I am not called upon to add much to my former explanation on this head, and shall confine myself here to stating, that as regards the more immediate object now in view, we may look upon the Colne valley as marking in a great part of its length, on the one side the escarpment caused by the outcrop of the plastic clay, whilst on the other, the country rises gradually to the north-western boundary of the chalk strata, the Chiltern Ridge.

An attempt to fix positive quantities, by any line of argument, is naturally attended with considerable difficulty; nevertheless, the following considerations will give some idea of the volume of water that can be derived from the chalk of the Colne valley.

The surface of country which has its drainage into the Verulam and Colne above Watford, may be taken at 113½ square miles. If, then, we assume that the annual fall of rain amounts to twenty inches, which you will find a low average, the result will be 14¼ millions of cubic feet of water per twenty-four hours, falling on the surface. Of this quantity, Mr. Telford found that the Colne carried off at Watford, thirty cubic feet per second, or about 2½ millions per twenty-four hours; as this was however in a dry season, it will be safer to assume Dr. Thompson's calculations, with respect to the annual quantity of water flowing off by streams and springs, which he was led to fix at four inches, and this would give us for the area drained by the Colne, not quite three millions per day.

There remain then 11¼ millions of cubic feet per twenty-four hours, either to be again evaporated, or to find their way into the earth. In an earlier part of this Report, you will remember that I showed that the porous nature of the soil, in a chalk district, prevents the evaporation to a great extent; nevertheless, if we assume that with the portion which enters into animal and vegetable life, one-third of the entire quantity falling, disappears in this manner, we still shall have upwards of 6½ millions of cubic feet, or 42 millions of gallons per twenty-four hours, supplying the sheet of water under that portion of the chalk surface.

Mr. Telford's examination of the body of water flowing off by the Colne river, having been made at a period of unusual drought, when the surface water might be considered to have nearly disappeared, we shall, I think, be correct in assuming that two millions at least of the quantity he measured, had issued from springs. In order therefore to represent the total subterranean flow, we should add these two millions to the former 6½. These indeed would form no part of the supply to the deep, but would designate that supply which has been already explained, cannot find its way to the lower depths, owing to friction, and other impediments, and therefore seeks a readier vent at a higher level.

It was important that this should be set in its proper light, as the evident inference we may draw is, that we cannot, by pumping from a lower level, a quantity small in comparison to the accumulation of water, produce any visible effect upon the springs which feed the Colne.

I am quite confident that my views as regards the manner in which the water finds its way into the strata of the chalk, will not for a moment be called in doubt by any scientific person, but that which may by such a one be considered in the light of a received axiom, and proved by numerous corresponding facts bearing thereon, with which he will be already acquainted, will require more lengthened demonstration to the general public, with whom an appeal to experience will have far greater weight than any abstract reasoning. To these then the experiments which have been made, will afford far more conviction than any argument however well founded.

The alluvial bed, which covers the bottom of the Colne valley, rather exceeds twenty feet in thickness, after which we reach the chalk: proceeding about five feet lower, abundant springs of water are encountered, which increase in magnitude and force as we continue to descend.

It was therefore in the first place necessary to ascertain that these did not derive their supply directly from the river, which, had it been the case, would have affected the various mills in the vicinity; and it was also desirable to have direct proof of the quantity which might be calculated on being obtained. In order to obtain positive evidence on both these points, a well was sunk in Bushey Hall meadows, near the Colne, to a depth of about 34 feet. Two small steam engines were then set up temporarily, for the purpose of working four pumps, of which two were 13 inches in diameter, with a length of stroke of 20 inches, and the others were 13½ inches in diameter, with a 36 inch stroke. One of the engines might be calculated to produce from 27 to 30 strokes of the smaller pumps per minute, the other between 17 and 20 strokes of the larger pumps. The water of the well was now repeatedly pumped out, as low as the power of the engines admitted, and the height of the Colne at these times carefully noted, and it soon became obvious that the height of the springs could in no degree be said to affect the level of the river, thus shewing that all direct communication between the two might be considered as cut off by a bed of puddle or clay. The next object of enquiry was as to the supply which a well might be expected to yield, and the result of a careful experiment, made under my direction, and confirming those previously conducted by Mr. Paten, satisfied me that after the water had for 24 hours been kept at the lowest level to which the power of the pumps would reduce it, (about 26 feet below its surface when undisturbed,) it rose in the well with a velocity equal to 2·02 feet per second, thus yielding 174,500 cubic feet, or 1,091,000 gallons per 24 hours. As this was obtained in a

well, the bottom of which was only 12 feet 6 inches diameter, and as direct proof had been obtained by borings, that below the 34 feet reached in the well, there was a constant recurrence of large springs, giving evidence that the water rapidly increased with the depth, which when 80 feet were obtained, became so prodigiously plentiful as to set all temporary means of overcoming it at defiance, and precluded all possibility of having recourse to it for the mere purposes of an experiment, I thought it quite unnecessary to seek further proof that a sufficient supply for all requisite purposes might with facility be obtained.

It would be premature to give, in the present stage of the proceedings, a detailed account of the arrangements I propose making, for augmenting the quantity to an adequate extent, and it may be sufficient to state here *that I have not the slightest doubt*, that by sinking a deep well, and extending tunnels, or drifts in the proper direction from its bottom, *the necessary supply will be fully accomplished.*

Being also convinced that the water filtering through the chalk might be considered as entirely divested of all impurities, held in mechanical suspension, of which, indeed, there was abundant ocular demonstration, (as it was so beautifully transparent as to admit of the bottom of the well being seen when the water was upwards of thirty feet deep,) I at once turned my attention to the best means of conveying it to London.

The principal difficulty which intervenes is the ridge formed by the escarpment at the outcrop of the plastic and London clays, which Mr. Telford in his proposal to bring the water of the Verulam stream to London, had contemplated perforating by a tunnel three and a-half miles in length. My connexion with the London and Birmingham Railway has placed me in possession of facts which convince me that at the level at which Mr. Telford would have traversed some of the beds of the chalk, and the whole of the plastic clay, he would have met with very great difficulty, in consequence of water. For this reason, I propose, on leaving the Colne valley, that before entering the ridge which separates it from the district draining into the Brent, the water should be forced to a height of fifty feet above its original level, at which elevation we get rid of the difficulties of the plastic clay, as we only traverse quite its upper extremity, where no water has yet accumulated. The length of the tunnel is also considerably reduced.

I have preferred adopting a Line which is materially shorter than Mr. Telford's, as, with the exception of the said tunnel 2½ miles in length, no difficulty of any kind is encountered. Immediately on the water re-issuing into the open air on the side of Brockley Hill, I propose forming a reservoir to contain three days' supply of water, with a sufficient head to admit of a main being laid hence, and conveyed, (in order to avoid all opposition from landowners,) from the town of Edgware to Oxford Street, along the side of the road itself; thereby also facilitating the laying of the main, and rendering all the works of any magnitude, as earthwork, aqueducts, &c. unnecessary. The level of the reservoir will lastly be such, that the highest service can be given; and indeed a part of the town, which none of the present companies can supply, will be included within its range.

I trust I have now said enough to convince an unbiassed person that there exists no difficulty, both in obtaining a supply of good water from the Springs of the Chalk, near Watford, and in conveying it thence to London. I must, however, impress you here with the necessity of enforcing my arguments, with as numerous a body of facts as can be collected; and I would therefore recommend that, previously to the meeting of Parliament, I should be authorised to collect such information respecting the quantity, nature and quality of the wells in every part of the chalk circle which surrounds London, as will bear practically on the subject. This might then be embodied in a second part or appendix to this Report, to be submitted to those who, being unacquainted with geological phenomena, may consequently hesitate in adopting views which others, already scientifically acquainted with the subject, will not for a moment call in doubt.

In concluding, I may be allowed to cast a retrospective glance at the advantages held out by the project I have been called upon to examine. These then consist in its being proposed to use spring water, already naturally filtered, in preference to that which has drained a portion of the earth's surface; in making use of that enormous reservoir which nature has supplied us with in the Chalk, and effecting this at a spot where no existing interests can be injured; and in the selection of such a situation as enables us to convey the supply to London with facility and economy, and at a sufficient elevation to satisfy the demands of even the highest part of the metropolis.

I have the honour to be, Gentlemen,
Your obedient servant,
ROBERT STEPHENSON.

London, Dec. 16, 1840.

ASSISTANT ENGINES UP INCLINED PLANES.

[At the last Meeting of the London and Croydon Railway, the following reports were read, respecting the use of assistant engines up inclined planes.]

To the Directors of the London and Croydon Railway.

Gentlemen—According to your instructions, I have written to the Liverpool and Manchester, the Grand Junction, and the London and Birmingham Railways, to ascertain whether the practice of assisting trains up inclined planes by an engine at the rear exists on those lines, and whether it has ever been found to be attended with danger or inconvenience.—I learn that on the Liverpool and Manchester Railway, the system is in *daily use*, and that it has never been found to be attended with dangerous consequences: on the contrary, it is considered *safer* with a long train to assist up an inclined plane by an engine behind the train rather than in front.—On the Grand Junction Railway, the assistant engine is behind in assisting up short and steep inclines; but elsewhere the assistant engine, if required for heavy or late trains, takes the lead. Hitherto, neither inconvenience nor danger has resulted from the practice, which is prohibited *except* on inclined-planes.—On the London and Birmingham Railway, pushing a train on the line is only allowed in cases where the power cannot be applied in any other way. Your obedient servant,

CHARLES H. GREGORY, Resident Engineer.

December 8th, 1840.

To the Directors of the London and Croydon Railway.

Gentlemen,—According to your instructions, I have this day tried an experiment, in the presence of the Chairman, Deputy-Chairman, and Mr. Baines, for the purpose of determining practically the effect of the assistant engine on the inclined plane at New Cross, and the actual amount of danger to be anticipated from the sustained pressure of the assistant engine in the case of any sudden stoppage of the train before it. With this view, a train was made up of five loaden coal-wagons of a gross weight of 30¾ tons (which is about equal to an ordinary passenger train). The *Croydon* engine was placed at the head of this train, and drew it up the inclined plane, with the *Hercules* engine assisting at the rear.—On the train acquiring a velocity of 22½ miles per hour, the steam of the leading engine was suddenly shut off. The effect was instantaneously felt in the assistant engine, on which the whole weight of the train seemed thrown back, causing a strong re-action, which reduced the velocity of the train to 15 miles per hour, the steam being still acting with full force in the assistant engine. The order was then given to stop the assistant engine: the steam was shut off, and the brake screwed down, when the engine instantly separated from the train, and stopped in less than its own length.—The same train was then taken up by the leading engine alone, and on attaining the same speed of 22½ miles per hour, the steam was shut off. The velocity of the train was reduced for the first furlong from 22½ to 12 or 15 miles per hour, being nearly the same as in the previous case, when the assistant engine was acting behind. The engine and train stopped in a distance of 7-32nds of a mile, without the use of the brake.—The practical inference from this experiment is valuable, as showing that there is a great deal of unnecessary alarm existing as to the supposed danger of the assistant engine on the inclined plane.—First. Any stoppage of the train is instantly felt on the assistant engine, which may be stopped before any serious result can arise from its overrunning the train.—Secondly. The effect of any sudden stoppage of the train is to cause such a sudden re-action on the assistant engine that for the first furlong afterwards it appears to communicate scarcely any impulse to the train, the velocity of the train after the steam is shut off in the leading engine being nearly the same, with or without the action of the assistant engine.—Thirdly. The retarding effect of the inclined plane is so great that the least obstruction would be sufficient to stop the train in a very short distance, even when the assistant engine is acting with full force. Your most obedient servant,

CHARLES HUTTON GREGORY, Resident Engineer.

It was stated at the meeting that Mr. M. Ricardo, of Brighton, had constructed a model of a machine which appeared likely to be of use not only in such cases as were now more particularly referred to, but in cases of collision.—The model was here exhibited. It consisted of a strong frame-work, somewhat similar to the frame-work of a goods-truck, the area being filled with powerful springs, so arranged as to collapse upon the application of a strong impinging force, the effect of the blow being thus of course broken.—A small experimental railway has been constructed at New Cross station, for the purpose of testing, as far as a model could test, the efficiency of the invention.

THE ORIENTAL STEAMER.

Abstract of the Log of the Peninsular and Oriental Steam Navigation Company's Steamer Oriental, John Say, Commander, on her second voyage from England to Alexandria and back.

		Distance in Miles.	Hours under Steam. H.	M.	Remarks.
Out.	Falmouth to Gibraltar .	1,039	143	25	Tremendous gales during three days.
	Gibraltar to Malta	989	91	0	Fine weather, average speed, 11 knots per hour.
	Malta to Alexandria	827	83	15	Fair weather.
Home.	Alexandria to Malta .	875	93	30	Heavy head sea.
	Malta to Gibraltar..	981	103	0	Fair weather.
	Gibraltar to Falmouth .	1,074	118	5	Heavy gales during three days.

Steamed, out, 2,885 miles, in 317 hours 40 minutes.
— home, 2,880 miles, in 314 hours 35 minutes.

Total distance, 5,765 miles, in 632 hours 15 minutes.

Lowest average rate of speed from Falmouth to Gibraltar, violent gales, 7½ knots per hours. Highest average rate of speed, 11 knots per hour.

IMPROVEMENT ON ECCENTRIC RODS.

Sir—A plan has long been desired for working the sliding valves of a locomotive engine with two fixed eccentrics, (that is one to each cylinder) so as to give the lead correctly when the motion of the engine is reversed, that is to say, when the engine is working either way. There have long since been locomotive engines constructed with only two eccentrics, and so as to give the required lead to the valves, when working in either direction; but these eccentrics used to work loose upon the shaft, and when the motion of the engine was required to be changed, their situations were altered, by means of levers and catches. But before these catches could get to their proper places, the shaft was obliged to be turned, nearly half way round at least, therefore, each engine was furnished with a set of rods and levers to enable the engine man to work each valve by hand, until the shaft came to the proper place for the catches to go together. This plan, in consequence of the tediousness in reversing the motion, its being so very liable to get out of repair, and other objections, has nearly fallen into disuse.

The plan now almost universally adopted, consists of four, all of which are firmly fixed to the shaft. These eccentrics are so arranged that two of them work the valves when the engine is going in the forward direction, and the other two work the valves when the engine is going in the backward direction. The four eccentric rods are all connected to one main lever, namely, the reversing lever, and by this lever two of the eccentric rod-ends may be attached to, at the same time the other two will be detached from, the levers which work the valves. With this arrangement the starting, and the reversing, of the engine are so simple as to be performed by the greatest novice; while with the former, the engine man requires considerable practice before he can get properly into the way of starting and reversing.

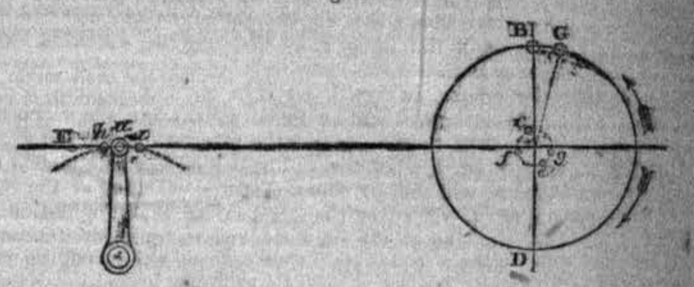
A plan for reversing the motion of the engine with greater ease, and for giving the lead to the valves with greater accuracy than that with four eccentrics, can hardly be desired; but it has long been the study of many ingenious persons to contrive a method from which they may obtain exactly the same result with *two fixed* eccentrics. This subject has, to my knowledge, been the cause of many experiments, some of which have by accident arrived pretty near to the point of correctness; but on their being performed upon a larger scale, in consequence of the persons engaged in them not being thoroughly acquainted with their ruling principles, they were deemed incorrect. There are those who have studied this subject so minutely, and made so many unsuccessful experiments, as to at last conclude it impossible to obtain this result in the manner alluded to. I have seen several ingenious diagrams intended to prove the impossibility, and I have even known attempts made to prove it impossible by geometrical demonstration.

I think it needless for me to enter into the details of the valve work, but, however, I will give you a short description of the method of setting the four eccentrics, which will refresh your memory with their principles, and at the same time perhaps, serve for as good proof of the plan I am about to describe, as can readily be given.

As the eccentrics, and all the other parts of the valve work, belonging to the one cylinder, are generally the same as, but quite independant of, those belonging to the other cylinder. And as each pair of eccentrics require to be set at exactly the same angle with their respective cranks, I think it will render the explanation much plainer, to only take into consideration the two eccentrics belonging to one cylinder, namely, one for the forward, and the other for the backward motion.

Suppose A B C D, fig. 1, to be a circle described by the crank, *a*, the lever to which the eccentric rods are to be attached, E C, a line drawn through the centres of the cylinder, end of the lever, and the crank axle, and B D another line also drawn through the centre of the crank axle, but perpendicular to E C. Suppose it to be at C. Now, when the crank is in this situation, the piston will, of course, be at the end of the cylinder; and the lead is generally considered as the distance the valve has moved from the middle of its stroke, or as the distance it is open, when the piston is in this situation. To give this lead, when the engine is working in the direction shown by the arrow F, the eccentric must be set about *c*; and the perpendicular distance from the line B D to *c*, is the quantity of lead in the eccentric. Now, when the rod belonging to *c*, namely, the eccentric rod, is attached to *a*, the valve will have the lead for working the engine in the direction shown by F, and it will continue to open until the crank arrives at G. But if the crank be turned in the direction shown by H, the eccentric will cause the valve to move in the wrong direction, and, consequently, allow the steam to act contrary to the motion of the piston; therefore, another eccentric *e*, is furnished, which is set at exactly the same angle with the crank as *c*, but on the opposite side. Both of the eccentric rod ends are connected with the reversing lever, as I have before observed, by which they may be detached from, and attached to the lever *a*, at pleasure. It will be seen, by a little attention to the figure, that the changing of the eccentric rods, when the crank is at C, will produce no alteration in the position of the valve, neither is it necessary it should, because the piston is then at the end of its stroke, and, although the crank be required to turn in the other direction, the steam will still be required to act upon the same side of the piston.

Fig. 1.



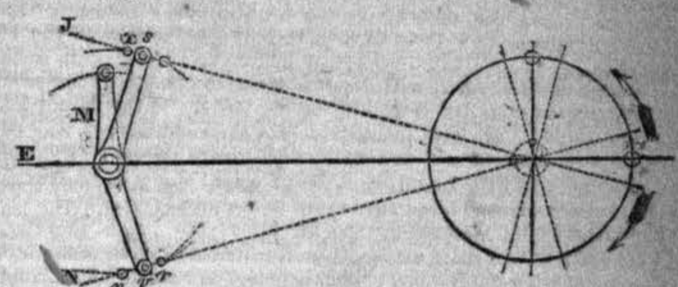


Fig. 2.

Let us now suppose the crank to be at B, the eccentrics will now be at *f*, *g*, and the piston about the middle of the cylinder. When the engine is intended to work in the direction of F, the rod belonging to *f*, must be attached to the lever, which will cause it to stand at *h*, and consequently the valve will be wide open, with the exception of the little difference caused by the lead. To reverse the motion, that is to say, to set the valve for working the engine in the other direction, the valve must be made to slide so as to open to the same extent, to allow the steam to act upon the contrary side of the piston. This is accomplished by the reversing lever, which detaches the rod belonging *f*, and attaches that belonging to g, which, by means of its forked end, draws the lever from *h* to *i*, and consequently causes the steam to act on the other side of, and force back, the piston.

By a little attention it may be seen that, while the crank is in any point of its revolution, the changing of the eccentric rods will produce that alteration, in the position of the valve, required to reverse the motion of the engine; therefore, I think the two points, in which we have supposed the crank, will be sufficient to explain the manner in which the lead is effected, and the motion reversed by the two fixed eccentrics to each valve.

I shall now proceed to explain the principles of a plan for giving the lead to the valves, and reversing the motion of a locomotive engine, with two fixed eccentrics, instead of four. In the following explanation, for the same reason as in the foregoing, I shall only speak of the valve, &c., belonging to one cylinder.

Suppose (as in fig. 1,) the circle A B C D, fig. 2, to be described by the crank, E C, a line drawn through the centres of the cylinder, and crank axle, and B D to be drawn perpendicular to E C. Suppose the crank to be at C, and the eccentric at *e*. After having determined the quantity of lead to be given by the eccentric, draw the lines F G, and H I, at the same angles with the crank, as you would set the eccentrics in fig. 1, to the same quantity of lead. Then draw the line J K, perpendicular to H I, and that end of the lever to which the eccentric rod is attached when the engine is working in the direction of L, must come in this line; supposing the valve to be worked from the lever M. By a little attention it will be perceived that, by setting the end of the lever in this situation, the valve will have the same quantity of lead, as it would if the lever and eccentric were set as in fig. 1. To cause the engine to be right for working in the contrary direction, no alteration is necessary in the situation of the valve; still it would not do to let the eccentric rod remain attached to *s*, therefore, I introduce another lever *v*, the end of which comes into the line N O, which is drawn perpendicular to F G, and, by means of the reversing lever, I detach the eccentric rod from *s*, and attach it to *v*, which will still

allow the valve to have the lead, and also cause it to move in the proper direction, when the engine is working in the direction of P.

Let us now turn the crank to B. The eccentric will now stand at *w*. To cause the piston to work the crank in the direction of L, the eccentric rod end must be attached to the lever *s*, as before, which will cause it to stand at *x*, and consequently cause the valve to be wide open, with the exception of the little variation caused by the lead, as I spoke of in fig. 1. To reverse the motion, that is, to cause the crank to turn in the direction of P, I remove the eccentric rod end from *x* to *r*, and by this means (the eccentric rod end being properly formed) the lever will be drawn from *r* to *n*, consequently the valve will receive the same change as it did in fig. 1, by changing the eccentric rods, when the crank was at B.

By setting the cranks, in figs. 1 and 2, in any two corresponding points of their revolutions, it will be found that, when the eccentric rod in fig. 2, is attached to the lever *s*, the valve will be in the same situation as that of fig. 1, when the rod belonging to *c* is attached to the lever *a*. And it will also be found that the changing of the two eccentric rods in fig. 1, will effect the same change in the situation of the valve as the removing of the eccentric rod in fig. 2, from the one end to the other. Hence it is evident that one eccentric, with the two levers, arranged in the manner described, will produce the same effect, in every respect, upon the valve, as is now produced with the two eccentrics.

The distance *s r*, fig. 2, will depend upon the length of the eccentric rod, and the quantity of lead in the eccentric. If the eccentric be required to give a greater quantity of lead than common, it will perhaps be advisable to use two bell crank levers instead. But these particulars are of little importance, the principal object to be attended to is to set the ends of these two levers in the proper places.

I am afraid I am trespassing too far upon your pages, therefore I will conclude with a short explanation of a little deviation in this latter arrangement from the former, which, before, I did not think worthy of notice. When the crank is at C, fig. 1, either of the eccentric rods may be attached to the lever *a*, without moving it. But in fig. 2, when the crank is in that same position, it will be found that the eccentric rod cannot be removed from *s* to *r*, without making a little alteration in the levers. It would be a waste of time to enter into a minute explanation of this little alteration, which is caused by the vibration of that end of the eccentric rod which is in connection with the eccentric; upon the same principles as the piston is caused to be in the middle of the cylinder when the crank is at B.

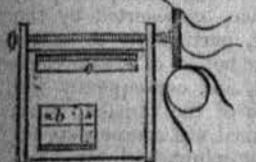
I remain, Sir, your's, very respectfully,

JOHN CHARLES PEARCE.

Leeds, Nov. 9, 1840.

IMPROVEMENT OF THE HYPSOMETER.

SIR—The ingenious little instrument for taking altitudes, invented by Mr. Sang and described in your last number, appears to me greatly deficient in one particular, and that is in the means of obtaining a level base line on which to conduct operations; the absence of this quality, indeed, renders it almost useless on uneven ground, and should the base be extended over a space of 80 or 100 feet or yards, the difficulty greatly increases; in this case, to trust to the eye for obtaining a level, would be out of the question; one might as well guess the altitude at once, as a quicker and equally correct method of arriving at the desired result; the instrument, therefore, if used alone, is rather contracted in its sphere of usefulness, an additional observation with a spirit level being necessary to obtain a near approach to truth. In saying this, my intention is not in any way to detract from the merits of Mr. Sang's invention; on the contrary, I confess myself much taken with it, and on that account have been turning over the scanty resources of a cranium somewhat obtuse, in hopes of finding something that might obviate the defects, which appear as such, in my humble opinion.



I would propose, therefore, the addition of a small milled-headed steel bar, an isosceles triangle in section, on which the instrument should be suspended; balancing itself thus, a base line will be obtained constant in its level; a cross wire over the aperture *b* will be necessary to complete the line of collimation. By these simple additions, altitudes may be taken with much greater precision, and the instrument will also acquire the properties of a level, sufficiently accurate for the purposes of gardening, for draining, or for levelling banks, and may be used generally except where great mathematical nicety is required.

Should you consider this modification, which springs from a dull man's brain, worthy a place in your Journal, it might, by chance, be turned to good account by some of your more intelligent readers.

AZIMUTH.

Liverpool,
December 9th, 1840.

REVIEWS.

Companion to the Almanac for 1841. Knight and Co.

WE are requested to explain in our notice of the present volume of the "*Companion*," a most singularly unlucky and vexatious accident which has befallen pages 245 and 6, owing to the hurry with which the sheet containing them was made up for press, nor was the mistake discovered till it was too late to correct it by a cancel, the larger number of copies having previously been disposed of. Those of our readers, therefore, who may have happened to have already perused the architectural section, must have felt completely mystified by the descriptions of the Reform Club-house and the Corn Exchange, for they are so strangely intermixed and shuffled together, that it is utterly impossible to understand either as now put together by the printer, who has clapped down the saloon of the Club-house in Mark Lane, and *vice versa* put the newly modelled area of the old Corn Exchange into Mr. Barry's building in Pall Mall—which, it seems has been improved by Mr. Morris and decorated by Bielefeld. Perhaps this last rather startling piece of information may excite the architectural reader's suspicion, and satisfy him that there must be some mistake, although he may probably not be able entirely to unravel it,—or even if he can do so, to account for it—how by any possibility it could have occurred. In a monthly publication such a blunder would have been of much less consequence, because there the opportunity of rectifying it would have soon occurred, whereas a twelvemonth must elapse before the readers generally of the "*Companion*" can be satisfied that the architectural critic was not actually *muzzy* when he made his remarks on the two buildings in question.

The best way of correcting the mistakes will be to quote the passages where they occur. Speaking of the Reform Club-house he says: "We had imagined that the two smaller divisions both in the coffee-room and the drawing-room above it, would be separated from the other compartments into which those rooms are divided, by screens of —— columns, instead of which we now find that there are only attached columns at the angles of the projecting piers which form the breaks on the sides of those rooms, &c." Thus it will be seen that the latter portion after the —— in our quotation, and the rest of the article should be transposed from page 246 to the preceding one, and be connected with the line ending with "screens of." Which being done, the other blunder rectifies itself, it becoming obvious that the remainder of page 245, line 13 from bottom, belongs to the account of the Corn Exchange, where the paragraph now rendered unintelligible would read thus: "The order is an Italian Doric, the columns of which are so disposed as to form a parallelogram on the plan, having five intercolumns on each side, and three at each end, but in the upper part this shape is converted into an oblong octagon, the angles being cut off by the entablature being carried —— from the column next the extreme one to the corresponding column of the adjoining side. The attic and ceiling follow the plan of the entablature, and the second of them consists entirely of a very deep cove, through which the light is admitted by means of glazed compartments. The centre, however, or what would be the flat portion of the ceiling is neither glazed nor covered in at all, but forms an opening of thirty feet by ten (surmounted by a cornice and balustrade) consequently the shelter from rain is not altogether so complete as it might be."

Having quoted enough to correct the wholesale error on the part of the printer, by connecting the passages he had dissevered, we now proceed to make some remarks of our own, noting as a curious circumstance the alteration which has lately been made in the old or south area of the Corn Exchange, in order to shelter it from the weather, at the very time that a design has been adopted for the Royal Exchange, with an uncovered area or open cortile, surrounded as formerly by a covered ambulatory, which though protected from rain above, must be partially exposed to that, and to other inconveniences attending inclement weather—to damp, fog, and wind. We do not mean to say that Mr. Tite's design is at all more objectionable in that respect than were the others; on the contrary, it is far less so than the generality of them, on account of the very great depth, he has given to the colonnades. What strikes us as singular is that the Gresham Committee should have settled that very important point,

for themselves beforehand, instead of allowing the competitors to have been guided as to it, by their own judgment. Had that been done the majority of them, we conceive, would have made their central area covered in,—unless deterred, perhaps, by the apprehension that it would be rejected as a new-fangled idea—an impertinent attempt to improve upon the former edifice.

The comments in the "Companion" on the Reform Club-house, will be best understood by referring to the ground-plan of that building, given in our last number; from which it will be apparent that by insulating the columns in the coffee-room, and placing them at some distance from the piers to which they are now attached, four colonnades or screens might have been formed with the same number of columns as at present. This would certainly have been attended with greater richness of effect, nor can we suppose that it escaped the architect himself; but it may possibly have been objected by the members themselves as tending to divide off the room too much, and to diminish its apparent spaciousness and extent. Yet—supposing this last notion to have been entertained, we consider it an erroneous one; for the appearance of extent would have been rather increased than at all diminished, by having a vista through a succession of spaces, one beyond the other—which would certainly have been more novel in character than the plan now adopted.

Of the new Church at Lee, Blackheath, which forms the subject of one of the cuts, a tolerably full account is here given, and it is spoken of as being greatly above the average quality of modern churches. Two circumstances are undoubtedly very much in its favour; one is that it has no side galleries; the other, that all the windows are filled with stained glass, "whereby a very unusual degree of richness and solemnity is imparted to the whole interior, so very different from that raw and garish, and we might almost say, 'worldly,' every-day light which prevails in the generality of our churches. These windows have been executed by Mr. Wailes of Newcastle, an artist who has here given proof of his study of ancient examples of the kind, particularly in the east window or windows, which have none of the gaudy, theatrical glare that is so offensive to good taste in many modern specimens of painted glass." Another specimen of superior design, here exhibited in an outline wood-cut, is the Catholic Chapel at Bury Lancashire, by Mr. J. Harper of York. The west front, which is the only part shown in the cut, displays exceedingly good taste, the design being composed of few features, but those well treated, and made the most of, so that there is, with much simplicity, a more than ordinary degree of richness, and boldness also. The octagon tower springing out above the gable, may be styled a novelty, although we believe that precedent may be found for it.

The Derby Arboretum, where Mr. E. B. Lamb was employed as the architect, and Mr. Loudon to lay out the grounds, is here noticed with deserved commendation, and as an instance of beneficially applied public spirit, on the part of its liberal founder Mr. Joseph Strutt, who seems to have very different notions of munificence from the late Sir John Soane. We hope that Mr. Strutt's noble example will not be lost upon others; for we are of opinion that public gardens and promenades of the kind are calculated to have a beneficial moral influence on the population of our towns. With this remark we take our leave of this new volume of the "Companion," which requires no farther recommendation from us than what we have already bestowed on its predecessors.

Schinkel: Werke der Höheren Baukunst. Erste Leiferung. Potsdam, 1840.

It is somewhat premature to express any decided opinion as to this new and more costly series of designs by Schinkel, as this first Leiferung of the work contains only a portion of those for King Otho's Palace at Athens, nor does it comprise any letter-press. Still we are fain to make some remarks *ad interim*, both in respect to the general character of the publication, and the subject of the plates that have already appeared. It announces itself at first sight as an architectural *Prachtwerk*, and may therefore recommend itself all the more to some by its expansive size; but to many, we conceive, not only its size, but its shape will be objectionable, the form like that of the author's former series being an oblong folio, and this when opened extends to six feet! whereas had the upright form been adopted it would have opened only four feet. As regards the substance of the work, this is a matter of perfect indifference, yet it is a circumstance of considerable importance as regards its usefulness, because volumes of such ungainly dimensions and proportions are anything but convenient for reference, however well they may be adapted for occasional display; and at all events there was no occasion to enhance the inconvenience of size, by adopting the oblong shape, which last renders the work almost unfit for binding.

Whether many of the subjects are such as absolutely to demand plates of so large a size, we cannot at present tell. Probably there may be some interiors on a very large scale, but the subjects in the *Leiferung* before us, might have been just as well shown in plates of half the dimensions. For instance, the first plate exhibits a general elevation of the design for the palace on the Acropolis at Athens, and a section of the rock itself; but the buildings are on so small a scale that the whole of them do not occupy a space exceeding 20 inches in length by 4 in height, consequently a plate of half the size would have been ample enough. Besides, as the whole consists not of one uniform composition but of distinct ranges of building united together, the separate parts of the group might have been shown more advantageously on a much larger scale in one plate, by placing them one over the other, as is done in in the plate of the two sections. Unlike those in the '*Entwurfe*,' the elevation and the two sections are here shaded, and the former is coloured also; which we certainly do not think is any improvement upon the first work, for besides that the scale of the drawings is so small that shadowing renders their details indistinct: the elevation alluded to—which gives that of the remains of the Parthenon as seen before a part of the palace, consists of so many planes that pictorial effect is entirely out of the question, the whole having too much the appearance of a jumble. Neither is the colouring well executed in itself, being poor and washy, while the shadows are almost of a violet hue. Another circumstance which produces a more singular than agreeable effect, is that instead of being projected at an angle of 45 degrees, the horizontal shadows are so exceedingly broad that those of the cornices, notwithstanding that the latter have very little projection, extend to the lower facia of the architraves; which at first gives the idea of an unusually projecting roof. Colouring should, in our opinion, have been reserved for the perspective views and interiors. There is a larger outline elevation of one portion of the design, namely, of the façade of the Chapel at the south-west angle of the Palace, which enables us to judge of its style and details. It consists of a Corinthian monoprostyle, tetrastyle, projecting from the wider and loftier body of the Chapel, which like the portico itself is crowned by a pediment, and both pediments are enriched with sculpture. As there is only a lofty doorway within the prostyle, and the parts on either side of the latter are unbroken by windows, there is sufficient repose, and the advancing portico serves to give play to the composition. Yet if so far we are well satisfied with this elevation, there are other circumstances in it which are decidedly objectionable, the principal one of which is that though it is placed upon a lofty stylobate or platform, the ascent to the portico is by a narrow flight of steps in front, not exceeding the width of the centre intercolumn and the pillars forming it. Even in perspective the effect must be rather poor, and as shown in elevation it is quite disagreeable. Though their mouldings are sculptured, the cornices of the two entablatures are meagre in their profiles,—not at all distinguishable from Ionic; neither are the capitals marked by much of Corinthian luxuriance. We must confess that we are a good deal disappointed in the design generally, as here shown; for it does not realize the expectations we had formed of it, from what has been said on the subject of it by Quast, and the reviewer of his book, in the 35th Number of the Foreign Quarterly.

The combustion of Coals and the prevention of Smoke chemically and practically considered. By C. W. Williams. Part the First. Liverpool, Thos. Bean. London, J. Weale.

The object of this treatise is to show, on chemical principles, what errors are usually committed in the mode of burning coal in the furnaces of steam-boilers, and by what means the combustion of that fuel may be rendered the most perfect possible, and the formation of smoke effectually prevented. The style of the work is far from concise, yet, as the views therein set forth are based on sound principles, and their application (if found to be practicable, as asserted by the author) must be attended with great benefit, particularly to steam navigation, we confidently recommend it to the notice of steam engineers and others, to whom economy of fuel, and consequently the perfect combustion of coal, on the large scale of the furnace, is an object, being assured that the information gained will compensate for the *labour* of the perusal, although we think it might, with great advantage, have been condensed into one half of its present volume, if not less.

The author insists, with good reason, on the importance of attending to the chemical constitution of the fuel, and to the processes which go on, and the combinations which take place in the furnace during

the progress of its combustion. He is, however, unreasonably fastidious with respect to certain received expressions, and frequently diverts the reader's attention from the immediate object of inquiry by ill-timed repetitions and observations, which render the perusal exceedingly tedious.

The 1st section treats of the constituents of coal, and the generation of coal-gas. In reading this, we were surprised to find that the author, who is so strenuous an advocate for accuracy of expression, even where it does not affect the facts considered, has himself, in one instance, made use of an inappropriate term, and that in a case where it has a tendency to mislead as to the main fact on which he is dilating. In the 22nd page he considers coal as consisting of two portions, viz., "the carbonaceous or solid, and the bituminous or volatile portions." Farther on he observes:

"The first leading distinction is, that the bituminous portion is convertible to the purposes of heat *in the gaseous state alone*; while the carbonaceous portion, on the contrary, is combustible *only in the solid state*;" and again,

"The bitumen of the coal, by reason of the great proportion of hydrogen which it contains, absorbs heat with great avidity, the first result of which is its change from the state of a *solid* to that of a *tarry, viscous, semifluid*; and, subsequently, by further increments of heat, to the state of gas, with its enormously expanded volume."

These quotations suffice to show that the gases which result from the application of heat to coal are considered by the author to be produced by a *simple distillation* of the bitumen contained in the coal, which suffers thereby no alteration in its chemical composition; whereas the truth is, that they result from the *chemical decomposition* of the bitumen, which, by the agency of heat, is resolved into a volatile portion, which is evolved in the gaseous form, and an excess of carbon, which remains behind in the solid state. Or rather, the coal should be considered as originally a homogeneous substance, which, by the action of heat, is first fused, and afterwards, when its temperature becomes sufficiently elevated, is decomposed as above. It will be evident, from these remarks, that the expressions "bitumen" and "bituminous portion" ought to be rejected, and "gases" and "gaseous or volatile portion" substituted in their place.

The 2nd section, which contains merely some general notions of gaseous combinations, is very tedious, and might, without detriment to the work, be omitted. We shall, however, just quote one specimen of the superfluous observations with which this work abounds. We read, page 36,

"Although, for the purposes of the *furnace*, so much value is set on the solid carbonaceous portion—the *coke*, we must not, on that account, undervalue the heat-giving properties of *the gas*. Indeed, the extent of those powers is strikingly brought before us by the fact that, for every ton of 20 cwt. of bituminous coal, no less than 10,000 cubic feet of gas are obtained, for which we pay at the rate of 10s. for every 1000 feet; the heating and lighting properties of the *gaseous portions alone* of one ton of coals thus costing five pounds sterling."

Is this fact a proof of the great value of coal gas as a heat-giving body? Certainly not; it is, on the contrary, rather an evidence of the great quantity of heat expended in evolving the gas, which is no advantage, but very much the reverse. This, however, is not the question; for, unless we are content to use coke from the gas-works, we must be at the expense of separating the gas from the carbonaceous portion of the coal, and all that remains to be considered is, what amount of heat is the gas, when separated, capable of evolving, how we can utilize the greatest possible proportion of that heat, and lastly, whether the amount gained is worth any additional expense which may be incurred in its attainment.

The 3rd section makes us acquainted with the proportions of carbon and hydrogen which constitute carburetted hydrogen gas, and with the quantity of oxygen necessary for the combustion of each of its constituents, as well as the quantity of atmospheric air which is requisite to furnish that quantity of oxygen. It should be here observed that the author has applied the term "atom" to atmospheric air, solely for the purpose of reducing the latter to an uniformity with the other gases concerned, being perfectly sensible that atmospheric air is not a chemical combination, but a simple mixture of oxygen and nitrogen gases, not exactly in the proportions required by the theory of chemical equivalents, the volume of the oxygen gas being 21 instead of 20 per cent. of the whole volume of air. This difference is neglected for the sake of simplicity. We have also to point out an error in page 51, lines 9, 10, 13 and 14, where "eight atoms of air" is put for "four atoms."

This section is followed by an explanation of two diagrams, representing the combustion of carburetted and bi-carburetted hydrogen, which present the volumes of gases used, and of the products of combustion, certainly in a very striking form, to the imagination of the reader, but we doubt whether a simple table of volumes would not have answered the purpose equally well.

In the 4th and 5th sections the author disposes of the questions of *the quantity of air required for the combustion of the carbon, after the gas has been generated*, and of *the quality of the air admitted to a furnace*. The 6th section treats of *the incorporation of air with coal gas, and the time required for effecting the same*, and the 7th of *the mode of effecting that incorporation in the furnace, preparatory to combustion*, which are very important points to be considered in the present investigation. In the latter the author explains the principle of his patent furnace, in which the air is introduced to the gases evolved from the coal by means of tubes pierced with numerous small orifices, the effect of which arrangement is compared to that of a blow-pipe.

The 8th and last section of this Part has reference to *the place or situation where the air may be admitted into the furnace*, so as to act its part with the greatest effect; and the conclusion arrived at is, for reasons therein developed, that the air for the carbonized fuel on the bars must come from the ash-pit, and that that for the gas must be introduced beyond the bridge.

Pambour on Locomotive Engines. London: John Weale, 1840.

(SECOND NOTICE.)

IN our last number we were unable, for want of time, to give more than a very brief notice of this work, but we hope this month to make amends by analysing it throughout with that care which its importance deserves.

The mode of investigation adopted is briefly explained in the following paragraph, which we quote from the introduction of the first edition.

"The method constantly followed consists in taking, first, the primary elements of the question from direct experiment; then making use of those elements to establish a calculation in conformity with theoretical principles; and, lastly, submitting the results to fresh and special experiments, in order to obtain their verification. For the further elucidation of the formula, they are each time carefully submitted to particular applications; and, finally, to extend the use of the work to persons who may wish to find the results without calculations, the formulæ are followed by *practical* Tables, suitable to the cases which occur most frequently in practice."

The work is divided into 18 chapters, in which the various divisions of the subject are treated, followed by an Appendix, shewing the Expenses of Haulage by Locomotive Engines on Railways, from the Accounts of the Liverpool and Manchester, and the Stockton and Darlington Railways.

The first chapter is merely a description of a Locomotive Engine, and therefore needs no comment.

The second chapter, as we mentioned in our last number, is nearly a copy of the corresponding chapter of another work by the same author, entitled "*Theory of the Steam Engine*," a review of which will be found in the 2nd volume of this Journal, page 466. The present work contains, however, besides, in the 6th section of this chapter, a Table of 37 of the experiments made by the author with the view of ascertaining whether or not the steam left the Engine in the saturated state, that is, with the maximum pressure and density corresponding to its temperature, which experiments were merely alluded to in the above mentioned work. The results of these experiments are truly remarkable, since there is no exception to the perfect coincidence of the pressures, on the one hand, indicated immediately by the air-gauge, and on the other, calculated from the temperature marked by the thermometer. But, surprising as this coincidence is, we would by no means conclude therefrom, that such results were not actually obtained, being convinced of the fact which it tends to prove, viz. that the steam, after passing through the cylinder, leaves the engine in the saturated state; we would rather infer that the experiments were made with extraordinary care and with every precaution to avoid error.

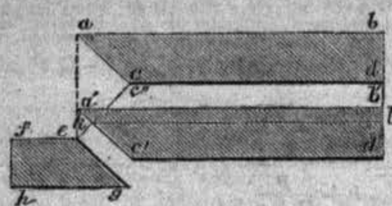
The third chapter treats of the Pressure of the Steam, and Article I. of the Safety-Valves in particular.

After explaining, in the 1st section, the mode of calculating the pressure according to the levers and the spring-balance, the author indicates, in the following section, the corrections to be made to the weight marked by that instrument. And here we cannot but express our dissent from the doctrine laid down with respect to the effect produced by the rising of the safety-valve on its surface exposed to the pressure of the steam. We read, page 90,

"......; but whenever the steam, being generated in greater quantity than it is expended by the cylinders, escapes with force through the valve, it raises considerably the disk of the valve: the consequence then is, that, instead of acting merely on the inferior sur-

face of the valve, it evidently acts on a greater surface, and which is still greater the more the valve is raised."

It is to the latter part only of this proposition that we object It is clear that the effective area of the valve must be augmented by its being lifted from its seat, and, if it is only raised a very minute quantity, merely sufficient to permit the escape of steam round the edge, the effective area of the valve will be increased from that of its lower to that of its upper surface; for in that case the steam, in passing through between the valve and its seat, presses against the whole conical surface of the former with sensibly the same pressure as exists in the boiler; but when the valve is raised considerably, as much for instance as twice its thickness, the steam, in escaping round the edge of the valve, will press on the conical surface of the latter with diminished force in consequence of the rapid enlargement of the space in which it is allowed to expand after having passed the lower surface of the valve. This will be evident on referring to the annexed dia-



gram, where *e f g h* represents the valve-seat, and *a b c d* one-half of the valve, in section, the rise *a e* being equal to twice the thickness *b d*. Now it is clear that the steam will pass upon the lower surface *c d* of the valve *a b*, and on the conical surface *e g* of the seat with the whole pressure in the boiler, but that, after passing the contracted orifice *c e* round the valve, it will immediately expand very considerably by reason of the rapid divergence of the surface *a c* and *e f*, and will exert but a slight pressure on the conical surface *a c* of the valve. But if the valve has only risen to the position *a' b' c' d'*, (supposing the rise *a' e* to be very small,) the aperture for the escape of the steam becomes that represented by the line *e k*, at right angles to *e g* and *a' c'*, so that the effluent steam will exert its full pressure, not only against the bottom surface of the valve, but also against all its conical surface from *k l* downwards. On the upper part *a' k* the pressure is but inconsiderable. as in the former case, so that the circle whose radius is *k l* may be looked upon as a near approximation to the effective area of the valve; and it is obvious that this area is by so much the greater as the rise of the valve is less, which is in direct opposition to the law laid down by M. de Pambour. We should express the law in general terms thus:

When the valve rests upon its seat, its effective area is equal to that of its inferior surface, or rather of the orifice covered by the valve; when the valve first begins to rise, its effective area is equal to that of its upper surface; and, as it rises more and more, the effective surface goes on diminishing, but according to a law which remains to be determined.

We therefore consider the calculation in pages 90 and 91 as fallacious.

Before quitting the subject we shall just offer a remark on the paragraph which closes this article, which is the following:

"The above established calculation, then, is to be depended on only when the balance-screw can be lowered so as precisely to equilibrate the interior pressure, as has been said above, without, however, allowing the valve to rise. But the thing is not possible when the engine produces a surplus of steam beyond what its cylinders can expand, because this steam must necessarily have an issue. In this case, then, the pressure is to be found only by recurring afterwards to the barometer-gauge, as we shall presently indicate."

It seems the most natural hypothesis, that, the blowing of the valve is a sign that more steam is generated in the boiler than can be expended in the cylinder *without raising the pressure in the boiler*, and that the blowing may *always* be prevented by a suitable augmentation of the weight on the valve.

The second article, which completes this chapter, contains a full description of the four instruments employed by the author to determine the pressure of the steam, with an explanation of the mode of using them, namely, the *barometer-gauge*, the *air-gauge*, the *thermometer-gauge*, and the *spring-gauge* or *indicator*.

The fourth chapter treats of the Resistance of the Air, and we are sorry to find this subject not so fully elucidated as we had hoped.

The apparently anomalous result observed by Borda, and confirmed by M. Thibault, namely, that large surfaces experience a greater resistance from the air in proportion to their area than smaller ones, when submitted to a circular motion round an axis situated in the same plane as the given surface, was easy to foresee. But, as M. de Pambour has neglected to give the explanation of it, we shall do so, in order that those, to whom the true reason may not occur, may not reject the proposition as absurd. The explanation will be found in the following calculation.

Let a square surface whose side $= a$ revolve round an axis, situated in the same plane as the given surface and at a distance r from its centre. Let the velocity of the centre $= v$, and let $\rho =$ the resistance of the air against an unit of surface moving at the unit of velocity, and R the resistance on the whole given surface. The resistance on an element of the surface extending across its whole width, and at a distance x from the axis of rotation will be

$$d.\mathrm{R} = \frac{a \rho v^2}{r^2} x^2 d.x;$$

whence we obtain by integration

$$\mathrm{R} = \frac{a \rho v^2}{3 r^2} x^3,$$

and, putting for x its maximum and minimum values, namely, $r + \frac{a}{2}$ and $r - \frac{a}{2}$, we have, for the resistance on the whole given surface,

$$\mathrm{R} = \frac{a \rho v^2}{3 r^2} \left[\left(r + \frac{a}{2}\right)^3 \left(r - \frac{a}{2}\right)^3 \right]$$

$$\text{or} \quad \mathrm{R} = \frac{a^2 \rho v^2}{3 r^2} \left(3 r^2 + \frac{a^2}{4}\right).$$

The resistance on an unit of area will be found by dividing the total resistance R by the area of the surface, which is a^2. We have therefore, calling π the mean resistance per unit of area under the above circumstances,

$$\pi = \frac{\rho v^2}{3 r^2} \left(3 r^2 + \frac{a^2}{4}\right) = \rho v^2 \left(1 + \frac{a^2}{12 r^2}\right).$$

The term $\frac{a^2}{12 r^2}$ shews that the above quantity increases with the ratio of the area of the surface to the square of the distance of the centre of the surface from the axis of rotation, so that, if this distance is constant the resistance per unit of area is greater for a large surface than for a smaller one, and that the same effect is produced by lessening the distance from the axis of rotation to the centre of the surface.

It is essential, therefore, as the author observes, that, when the circular motion is used to determine the resistance of the air, that the surfaces employed should be of very small extent compared to the length of the radius of rotation.

The following formula, to determine the resistance experienced by a body moving in the air at rest, is deduced from the experiments of Borda, Dubuat and M. Thibault.

$$\mathrm{Q} = \cdot 0011896 \, \epsilon \, \Sigma \, \mathrm{V}^2,$$

in which Q is the total resistance in lbs., V the velocity of feet per second, Σ the front surface of the body, traversing the air in a direction normal to that surface, and ϵ a coefficient which varies with the length of the body.

In applying this formula we must make

for a thin surface - - - - - - -	$\epsilon = 1{\cdot}43$
for a cube - - - - - - - -	$\epsilon = 1{\cdot}17$
for a prism of a length equal to 3 times the side of its front surface - - - - - - -	$\epsilon = 1{\cdot}10$.

In the 2nd section the author has given a table of 6 experiments on the resistance of the air against trains. Five wagons of different heights, loaded with goods, were drawn to the top of the Whiston inclined plane on the Liverpool and Manchester Railway, and were allowed to descend by their own weight, first separately, and afterwards all united in one train.

The comprehension of this table would have been greatly facilitated if the author had given some fuller explanations of the manner in which he determined the last number in the 8th column, expressing the effective surface exposed to the shock of the air, which gives, for the five wagons together, a friction equal to the sum of the frictions of the five wagons separate. We have worked out the formula given in page 152 with different areas of effective surface, and find the friction amount to 5·92 lb. per ton with 144 square feet, and not 130, as given by M. de Pambour. The surface of the highest wagon, augmented by that representing the resistance of the wheels and screened parts of all the five wagons, is equal to 127 square feet, and as we have found

the effective surface of the train to be 144 square feet, we must add $4\frac{1}{4}$ square feet per wagon, with the exception of the first, so that the effective surface will be found by adding to the area of the wagon of greatest section six square feet for the first, and $13\frac{1}{4}$ for each of the following wagons.

Assuming the value of V, or the velocity at the foot of the first plane to be correctly given by the question in page 148, we found that the hypothesis of any thing approaching to uniformity of motion could not by any means be reconciled with facts, but that by taking $\frac{2}{3}$ V^2 as the mean for the first plane, and $\frac{8}{15}$ V^2 for the second, the resistance of the air was correctly given by the equation we have quoted above. The square of the velocity at $\frac{1}{4}$, $\frac{1}{2}$ and $\frac{3}{4}$ of the length of the first plane are found by the above mentioned formula to be respectively equal to $\cdot 326\ V^2$, $\cdot 623\ V^2$ and $\cdot 864\ V^2$.

To simplify the calculation for general purposes a mean value of ϵ, namely 1·05, which is suitable to a train of 15 wagons, is substituted in the above formula, which thus becomes, when the the velocity is expressed in miles per hour,

$$Q = \cdot 002687\ z\ v^2.$$

This chapter concludes with a practical table of the resistance of the air against trains at velocities commencing at 5 miles an hour, and increasing by 1 mile at a time up to 50, the effective surface of the train increasing by 10 square feet at a time from 20 to 100. The resistance is expressed in lbs. on the whole train and on the square foot of effective surface.

Chap. V. On the friction of the wagons on Railways.

The only means of ascertaining the friction of wagons with any degree of certainty is by the circumstances of their spontaneous descent and stop upon two consecutive inclined planes. We therefore pass to the 3rd section of this chapter, which is an analytical investigation of these circumstances, as referring to a system of two wheels joined together by an axle-tree fixed invariably to each, and loaded with a given weight resting on a chair on which the axle-tree may turn freely.

"The inquiry comprises three successive questions: 1st. To determine the effective accelerating force to which the centre of gravity of the system will be subject in its motion; 2nd. To deduce from this the velocity acquired by the moving body at the foot of the first plane; and 3rd. To conclude finally the distance it will have traversed on the second plane at the moment when the friction shall have reduced its velocity to nothing,"

The motive forces applied to the system are first enumerated, in which the author includes, besides the motive forces properly so called, the passive resistances which oppose the motion, and which are generated by the motion itself. Among these there is one regarding which we think the author is in error, namely, the adhesion of the wheel on the rail. "It is this force," he says, "which produces the rotation of the wheel, by preventing its circumference from sliding without turning during the motion along the plane." This force is expressed by the weight T.

If this ought to be looked upon as a force, there must also unquestionably be an expenditure of power without any resulting effect at the fulcrum of every lever, for, as the above quotation proves, it is only in its capacity of fulcrum that the point of contact of the circumference of the wheel with the rail is here considered; what is called the rolling friction occupies the 6th and last place in the list.

It is a curious fact that this introduction of a false idea does not in any way influence the final result of the calculation: it serves merely to form an unnecessary intermediate equation, between which, and the principal equation when the quantity T has been eliminated, the resulting equation is the same as if that quantity had never entered into the calculation.

The two equations in question are

$$P \sin\theta' + p \sin\theta' - T - Q\ v^2 = \frac{P+p}{g}\ \phi,$$

$$\text{and } T R - f'\ P r \cos\theta' - f''\ (P+p) \cos\theta' = \frac{p}{g}\ k^2\ \psi,$$

in which P is the weight of the chair with its load, resting on the axle-tree, p that of the wheels and axle-tree, θ' the inclination of the plane to the horizon, v the velocity of motion at any moment, $Q\ v^2$ the resistance of the air at that velocity, g the force of gravity, ϕ the effective accelerating force which produces the motion of translation of the system, ψ the effective accelerating force which produces the rotation of a point of the wheel situated at the distance 1 from the axle, $\frac{p}{g}\ k^2$ the momentum inertiæ of the wheel, R the radius of the wheel, r that of the axle, f' the coefficient of sliding friction, and f'' that of rolling friction.

Now the former, or principal of the above equations ought evidently to have been

$$P \sin\theta' + p \sin\theta' - f'\ P\ \frac{r}{R}\ \cos\theta' - f''\ (P+p)\ \frac{1}{R}\ \cos\theta' - \frac{p}{g}\ \frac{k^2}{R}\ \psi - Qv^2 = \frac{P+p}{g}\ \phi.$$

Substituting $\frac{\phi}{R}$ for ψ, and 1 for $\cos\theta'$ as a sufficiently near approximation when the plane is but little inclined, and making

$$f'\ P\ \frac{r}{R} + f''\ (P+p)\ \frac{1}{R} = f\ (P+p),$$

we obtain

$$(P+p) \sin\theta' - f\ (P+p) - \frac{P}{g}\ \frac{k^2}{R^2}\ \phi - Q\ v^2 = \frac{P+p}{g}\ \phi.$$

Whence

$$\phi = \frac{g}{1 + \frac{p}{P+p} \cdot \frac{k^2}{R^2}}\ \left(\sin\theta' - f - \frac{Q}{P+p} v^2\right).$$

This is precisely the equation arrived at by M. de Pambour, page 145, which is transformed, for the sake of simplicity, into the following,

$$\phi = g'\ (\sin\theta' - f - q\ v^2),$$

the frictions represented by g' and q containing none but known quantities.

The accelerating force being equally represented by $\frac{v\ d\ v}{d\ x}$ (x being the distance traversed on the plane when the body has acquired the velocity v), this expression is substituted for ϕ, as well as b' for $\sin\theta' - f$, in the last equation, which thus becomes

$$\frac{v\ d\ v}{b' - q\ v^2} = g'\ d\ x,$$

which is the equation of the motion, and gives by integration between the limits $x = o$ and $x = l'$ = the length of the plane, calling V the velocity acquired at the end,

$$2\ q\ g'\ l' = \log.\ \frac{b'}{b' - q\ V^2},$$

whence

$$q\ V^2 = b' \left(1 - \frac{1}{e^{2qg'l'}}\right).$$

This gives the velocity at the end of the first plane, and consequently at the beginning of the second. The question now is to determine at what point of the second plane the body will stop, to solve which we have, calling θ'' the inclination of this plane, all the other circumstances of the motion being the same as before, except that, the inclination of the plane being so much less, that the body is brought to rest, the accelerating force $\frac{v\ d\ v}{d\ x}$ is negative,

$$\frac{v\ d\ v}{d\ x} = -g'\ (b'' + q\ v^2),$$

$-\ b''$ being substituted for $\sin\theta'' - f$.

Making, after integration, $x = l''$ for the distance traversed on the second plane, and $v = o$, since the body is brought to a state of rest, putting also for $q\ V^2$ its value found above, we have

$$\frac{b'}{b''} = \frac{e^{2qg'l''} - 1}{e^{2qg'l'} - 1}\ e^{2qg'l'}.$$

Finally, restoring the values of g', b' and b''; and calling h' and h'' the vertical heights descended on the first and second planes respectively, and making

$$\mathrm{Y}=\frac{l'}{l''}\,\frac{e^{\frac{2qgl''}{n+1}}-1}{e^{\frac{2qgl'}{n+1}}-1}\,e^{\frac{2qgl'}{n+1}}$$

we obtain definitively for the value of the friction f,

$$f=\frac{h'+h''\mathrm{Y}}{l'+l''\mathrm{Y}}.$$

We have been involuntarily led, by the ingenuity of this method of eliminating the resistance of the air, into giving a complete sketch of the calculation, but we do not think it more than sufficient to give an adequate notion of its nature and perfection.

The fourth section contains an account of 12 experiments made on the above principle on the Whiston inclined plane on the Liverpool and Manchester Railway, with trains consisting of different numbers of wagons and variously loaded, the results of which are collected in a table at page 161.

From these experiments, the mean friction of the wagons, taken independently of the resistance of the air, amounts to $\frac{1}{389}$ of their gross weight, or to 5·76 lb. per ton; but to simplify the calculations, M. de Pambour takes it at 6 lb. per ton, which makes $\frac{1}{373}$ of the weight of the wagons. He remarks, however, that, except in cases of extreme velocity, the resistance of the air may be computed with regard to the wagon of greatest section alone, according to Borda, taking the friction then at 7 lb. per ton.

Chap. VI. treats of the Gravity on Inclined Planes, and Chap. VII. of the Pressure produced on the Piston by the action of the Blast-pipe. This is a very important point, and requires much more experience and careful investigation, in which the results of experiment are compared with the laws of Natural Philosophy, before it can be considered as satisfactorily settled. In comparing the last column of the Table of Experiments, page 193, with the last but one, we find some great discrepancies, although the coincidence is in some cases perfect or nearly so. For example, we find the pressure on the piston due to the action of the blast-pipe,

		Observed. lbs.	Calculated. lbs.	Difference. lbs.
in one experiment	....	5·0	3·6	1·4
in another	....	5·6	4·2	1·4
"	....	5·8	4·1	1·7
"	....	5·3	4·1	1·2
"	....	6·2	4·4	1·8
"	....	2·4	3·4	1·0
"	....	5·6	4·5	1·1
"	....	1·8	4·2	2·4
"	....	1·0	2·7	1·7
"	....	1·2	2·5	1·3
"	....	5·0	6·7	1·7
"	....	3·4	5·5	2·1
"	....	4·3	4·1	0·2
"	....	1·8	1·8	0·0
"	....	2·4	2·1	0·3
"	....	2·3	3·1	0·2
"	....	2·3	1·9	0·4
"	....	2·0	2·1	0·1
"	....	2·4	2·6	0·2
"	....	3·8	3·4	0·4
"	....	2·1	2·0	0·1
"	....	6·0	5·7	0·3

Out of 38 observations given in the table, the last ten of the above selection present the nearest accordance with the numbers calculated by M. de Pambour's formula, while the first 12 exhibit discordances too great to permit us to consider that formula as confirmed by the experiments alluded to. We must, however, content ourselves with these determinations for the present, for want of more accurate data, but we hope the invesgation will not be allowed to rest here, since the theory of the Steam Engine is not complete without it.

This chapter concludes with a *practical table of the pressures against the piston, due to the action of the blast-pipe*, which furnishes the means of taking this effect into account in some degree, which is better than neglecting it altogether.

In chapter VIII. the friction of the engines, both unloaded and loaded, is very ably investigated, and illustrated by experiments, and in chapter IX. is ascertained the definitive resistance per unit of surface of the area of the piston resulting from the various resistances estimated in the preceding chapters.

In chapter X. are presented the details of 22 experiments on the vaporization of locomotive engines, together with an inquiry into the circumstances which influence the rate of vaporization, which tends to prove, 1stly, that this is not affected by (the load on the safety-valve) or pressure of the steam formed, 2ndly, that it increases with the velocity of the engine, all other circumstances being the same. The author even goes so far as to conclude from those experiments which bear on this point that the vaporization of locomotive engines varies very nearly as the fourth root of the velocity. We do not feel justified in adopting such a law on the strength of so few experiments, which do not *all* concur even in establishing the general truth. That the velocity of the motion does influence the vaporization we are not, however, disposed to doubt; we only wish to intimate that more numerous experiments must be made on the subject before the law of that influence can be deduced. 3rdly, it is shewn from the experiments, three of which were made without the blast-pipe, that this appendage to a locomotive engine increased its vaporization more than five-fold, but that the narrowing more or less of the orifice of the blast-pipe produced no very remarkable result. It appears, however, that a certain area or orifice produces a maximum effect for each engine, that area being for the STAR engine, according to the experiments here reported, about 3·13 square inches.

In the 5th section of this chapter, which treats *of the comparative vaporization of the fire-box and the tubes, and of the definite vaporization of the engines per unit of heating surface of their boilers*, the author asserts, page 270, that, "during the active working of engines of a construction similar to that of the experiments, the two portions of the boiler vaporize, per unit of surface, the same quantity of water." This equality is ascribed to the fact of the flame being drawn, by the force of the blast, through the whole length of the tubes, by which means the whole of their surface is exposed to radiating caloric, but there are probably other circumstances which tend to equalize the two portions of the boiler as to their evaporating power, as for example, the superior conducting power of the thin brass of the tubes over that of the iron plate of which the fire-box is made.

In the 6th section an estimate is made of *the loss of steam which takes place by the safety-valves, during the work of locomotive engines*; but it does not appear that there are any positive data on which to found the assumption of the losses here assigned. The calculation is based on the rising of the valve observed during the experiment compared with the rise which is sufficient to give issue to all the steam generated during the complete close of the regulator, without regard to the pressure in the boiler, which must doubtless influence the loss through the valve considerably.

In the 7th section the quantity of water drawn into the cylinders in the liquid state is shewn to amount to a considerable proportion of the water appended: the average of the severe experiments in the table at page 289 is 24 per cent., and in one case it appears to have risen to 36 per cent. But as the determination of this quantity necessarily depends upon that of the loss of steam through the safety-valves, it must be affected by whatever errors there may be in the latter. We think it probable that the escape of steam through the valve is more copious than M. de Pambour calculates it to be: in which case the loss by *priming* would be found to be less considerable. We are, however, compelled, in this instance also, to content ourselves for the present with the data here furnished us. Besides, as we are possessed of the facts ascertained by experiments, we must take it for granted, that there is no great error in the total loss both by the safety-valve and by *priming*, as the only difficulty consisted in distributing it between these two causes.

The explanation of the manner in which a deficiency of steam-room in a boiler causes it to prime is not applicable to a locomotive engine for it does not follow, because that space is but 10 times the capacity of the cylinder, that "at every stroke of the piston, a tenth of the steam generated will pass into the cylinder," and that "the remaining steam will be all at once reduced to 9-10ths of what it was before." The truth is that there is no cessation either of the generation or supply of steam to the cylinders: the latter is at no instant more than once and 4-10ths as rapid as at another, and is at the least nearly 8-10ths of the average supply.

In chapter XI. the subject of Fuel is treated in a very scientific and practical manner, both with reference to the absolute quantity which locomotives of different constructions are capable of consuming, and also with reference to the consumption required to effect a given vaporization.

From the experiments on this subject, of which the particulars are given in the 1st section of this chapter, and which are grouped in a table, page 298, according to the proportion between the heating sur-

face of the fire-box and of the tubes, the author concludes in the following section that the most advantageous proportion is as 1 to 9, or the total heating surface equal to ten times that of the fire-box; "since for a less proportion there would be increase in the expenditure of fuel, without increase of vaporization; and for a greater proportion, on the contrary, there would be reduction in the vaporization of the engine per unit of surface, which would incur the necessity of a larger boiler, and consequently of a greater weight, which it is important to avoid."

It also results from these experiments that, "according to the proportion of the fire-box to the total heating surface, the consumption of fuel in locomotive engines varies from 9·2 to 11·7 lbs. per cubic foot of *total* water vaporized; so that it may, on an average, be valued at 10·7 lbs. of coke per cubic foot of total vaporization."

It is to be observed that this *total* vaporization includes the loss by priming, so that the quantity of coke per cubic foot of water really converted into steam would be, according to M. de Pambour's calculation, about 14 lbs.

Of the 12th chapter, which treats of the Theory of locomotive engines, we shall merely observe that it is in substance the same as in "The Theory of the Steam Engine," to which work we have already alluded, but much more instructive with regard to locomotive engines, the peculiar circumstances of which are here discussed at much greater length. The application of the the theory is rendered easy by practical formulæ and examples, and its correctness corroborated by applying it to the results of a considerable number of experiments, collected in a table at the end of the chapter.

The theory is continued in chapter XIII., in the first 9 sections of which are solved the various problems which occur in the construction of locomotive engines, viz., to determine the vaporization or heating surface, the dimensions of the cylinders, and the diameter of the wheel, necessary for the engine to draw a given load at a given velocity; to determine the vaporization or heating surface, the pressure in the boiler and the dimensions of the cylinders, necessary for an engine to assume a given velocity or draw a given load, producing at the same time its maximum of useful effect; and lastly, to determine the combined proportions to be given to the parts of an engine, to enable it to fulfil divers simultaneous conditions. The utility of all these problems is too evident to require pointing out.

In the 10th section, which is an examination of the special influence of each of the dimensions of the engine on the effects produced, we have to direct attention to a slight contradiction. We read, page 417,

"Moreover, it will also be recognised that, for a given vaporization, the velocity will be by so much the greater as the factor $\frac{d^2 l}{D}$ has less value. It is in consequence to be concluded that, in order to augment to the utmost the velocity of an engine with a given load, we must either employ a cylinder of the smallest possible diameter, or make the wheel the largest possible with reference to the stroke of the piston."

It is a more direct inference that we must employ a cylinder of the smallest possible capacity in proportion to the diameter of the wheel. We read further:

"These consequences might however have been seen *à priori;* for if we suppose a given vaporization in the boiler, it is clear that the quantity of steam which will result from it per minute cannot issue forth in the same time by a cylinder of less diameter, except on the condition of increasing its velocity during its efflux, that is, of increasing the velocity of the piston. As to the ratio between the length of the stroke of the piston and the diameter of the wheel of the engine, as it is known that at every double stroke of the piston the engine advances one turn of the wheel, it is readily perceived that the larger the wheel relatively to the stroke of the piston, the greater must be the velocity of the engine with a given load."

In all this reasoning the author has lost sight of the circumstance that a diminution of the capacity of the cylinders, *with a given load,* will necessarily demand steam of a greater pressure, and consequently of greater density, in the cylinders; but, as the density of steam does not increase in proportion to its elastic force, there will be a slight increase of velocity with the smaller cylinders.

A little farther on, page 419, we are told that the load which an engine is capable of drawing at a given velocity "is diminished by the values of d, l and D, that is, by the dimensions of the cylinder, the stroke of the piston, and the wheel, which are proper to augment the velocity of the engine."

We were at first puzzled for an explanation of this contradiction, but, on examining the two equations from which the above deductions were drawn, we perceived that the latter were not justified by them, but that the same values of d, l and D which would increase the velocity with a given load would also increase the load with a given velocity, the fraction $\frac{d^2 l}{D}$ being *positive* in the *denominator* of one of the fractions, and *negative* in the numerator of the other. The error we have pointed out runs through the rest of the section.

(To be continued.)

Specifications for Practical Architecture, preceded by an Essay on the Decline of Excellence in the Structure, and in the Science of Modern English Buildings. By Alfred Bartholomew, Architect. London: John Williams, 1840.

We have so often made an attempt to examine this important work with the attention it deserves, that we fear we may be considered remiss by our readers in not attending to it before—the fact is that it contains so much matter intimately connected with the profession, that it is with difficulty we can select any one part in preference to another, a difficulty increased by the arrangement of the work. We have already, by permission of the author, given large extracts, which will be a sufficient testimony to our readers, that it is a work well deserving of the attention of every one connected with building, we will not say the profession alone, for it is equally as well deserving the notice of the public generally. Having said thus much, we must not be considered as agreeing with all the sentiments and opinions of Mr. Bartholomew, although we believe that what he has written, has been done in sincerity; we think that he has been too much imbued with the Wren-mania, and considers that nothing is now done equal to the buildings and architecture of the period previous to the eighteenth century—no doubt; many of our public edifices built during that period were executed with great judgment, but we know that many of them possess faults, nay very great ones; for how many of them do we find that have lossed their spire or steeple, and in others the piers of the main tower have given way, under the great pressure which they are made to carry. Nor do we find that all the buildings of that period were erected *fire proof*—we believe that very few of them have their vaulting of stone, some we have seen which so closely resemble stone, that they have been taken for that material until the visitor is told to the contrary. Although, during this period there were erected numerous ecclesiastical buildings, possessing architectural merit of the highest class, we should like to know how many buildings of a domestic character were erected, possessing any claim to architectural pretensions, in comparison with those which have been erected within the last century—now, the whole of a man's fortune is not placed at the mercy of the priest, for external pomp to support an intolerant church or to prevent the soul from going to purgatory; no, part of that fortune is now devoted to the erection of edifices, which form an ornament to many parts of the united kingdom, and we hope to see them still farther increase.

Another part of Mr. Bartholomew's bewailing is on account of the use of Bath stone and cement; no one will dispute that if you can obtain funds sufficient, that it is far better to use Portland stone, but the immense cost of labour on that material is a bar to its general introduction, and it is on account of the cheapness and facility in the use of cement for giving architectural character to our buildings, that it is so largely introduced. We believe that the fault in the use of it is by allowing the workman to have cement of an inferior quality, or in permitting it to be employed by men that do not know how to mix or apply it.

That part of the volume which treats upon Specifications, possesses some very useful hints for those who are not well conversant with that branch. We feel ourselves very strongly inclined to recommend that specifications should at all times be drawn up by parties who will make it their peculiar study; such a person would be of as much service to the architect, as the special pleader or equity draughtsman is to a lawyer.

The information on construction will be found valuable to the student, who will do well to peruse attentively the general contents of the volume.

We think the work would have been clearer had it not been split up so much into chapters and sections, which however convenient for reference, are embarrassing to the reader. This is even carried out in the specifications, so that a specification is interrupted by chapters and sections. We must not, however quarrel with Mr. Bartholomew, for he is too steady a reader of the Journal not to enlist our sympathies; some of our correspondents however seem, by the remarks in his work, to give him a good deal of trouble. He devotes especial mention to Candidus. We must now leave Mr. Bartholomew, and his work with a hearty commendation to our readers for its usefulness.

THE ARCHITECTURE OF LIVERPOOL.

By a Stranger.

Not deeming myself bound to continue these remarks according to any fixed rule, I shall merely note each of the "Architecture of Liverpool" as comes first in my way, during my peregrinations through the town, without regard to their proximity to each other or even their relative importance. I shall, therefore, now turn my face towards the place where the wise men of old came from, namely, the east, and make a few remarks on the Railway Station. This is a mere screen, little better than a blank wall, hiding, instead of setting off, the great works that are going on behind it. It is a long, low, flat façade, broken into many unmeaning parts, without end or aim, having six and thirty engaged columns very nearly in a line, like a regiment of soldiers leaning against a wall, set upon pedestals, and supporting an entablature, and over the centre and side entrances having heavy masses of stone-work. This station is a great failure. Instead of being a grand substantial gateway, suitable to the commercial dignity of this great town, and the incalculable importance to mercantile men of railway transit,—instead of an entrance suitable in height and dignity to so important an object, which, by its outward appearance, should tell of the great things going on behind it, and thus serve as a title page to its contents, here is a long, low wall, ornamented, it is true, with columns, &c., but still giving no one any idea, by its outward expression, of its nature or intents. Every edifice should express its object. A church should display gravity and dignity, a theatre lightness and gaiety, a prison rude majesty and sturdy strength; in short, every edifice should, like the countenance, express the spirit. But, in this erection, besides this want of expression for the intended object, the thing is not good in itself. The expression of a column is that of support to something superincumbent. But what do these support? Why, they are themselves stuck against a wall where they are not required, for, we naturally suppose, a wall can support itself; and over them is an entablature, which might, also, have been supported by the said wall. Moreover, this entablature is in itself but indifferent, and it is broken into petty parts, wanting that continuity of outline so necessary in large edifices for effect and dignity; and all this is to no useful purpose, but merely to hide the railway. How much better would it have been to have made these now useless columns available, and placed them at the outside of the pathway, thus forming a colonnade, for shelter from sun and rain, with bold but unbroken entablatures; and, in the centre, made a very large and handsome gateway, worthy of the town, somewhat similar in style to those of Birmingham and London, albeit they are not quite faultless. But I must, in justice, add, that the columns are well wrought and proportionate, the mouldings good, and the basement and pedestals bold, substantial, and somewhat original.

One of the most important architectural edifices in the town, as well from its size and prominent position as from its cost, is Saint Luke's Church, which crowns the summit of a gentle ascent, and forms a beautiful termination to the view at the south-east end of Bold-street. It is one of the finest and most picturesque buildings of its kind in the county. This has been a most successful attempt at the opprobriously termed Gothic, a name sarcastically applied to the sublime architecture of the middle ages, by Sir Christopher Wren, whose own tasteless attempts in that style show how little he understood the artist-like feelings or the grand conceptions that enabled the monastic architects to raise edifices remarkable for boldness, scientific construction, and that fascinating and almost magical effect of chequered light and shade, which, combining, at times, the most playful effects, as in their small oratories and chapels, and, at others, the most sublime and elevating, raising the feelings of the devout, and appalling even the infidel, produced architectural effects that have not been equalled even in the present day of knowledge and enlightenment. St. Luke's Church consists of a nave, chancel, and tower. The details of the exterior of this church are exceedingly good, and show that the architect had a chaste appreciation of that style. The windows, battlements, buttresses, pinnacles, &c. are almost all unexceptionable, which, with the admirable tone of colour in the stone, produce a very fine effect. The chancel is a copy of the Beauchamp Chapel, at Warwick. This chancel, though beautiful enough in itself, looks sadly likely an excrescence or after-thought, tacked on to the main building, which idea is still further kept up by the difference of style, which is of later date than that of the nave. Why should this have been done in a modern edifice? Why, in an edifice built at the same period, combine the incongruous styles of several periods? for, in the Gothic style, there are many eras, each characterized by certain distinct features essentially different from all the rest; and thus the antiquary may trace the date of erection of almost any ancient building to within a very few years. It may be replied, that there are remains of many buildings of different styles. True. But the reason is, that they were built at different periods, each in accordance with the style of its own date, thus creating a great jumble of styles, often picturesque, but rarely chaste or correct, or forming one homogenous mass. Nor can any one produce a single ancient edifice built at the same period but in different styles. Thus we plainly see, that this mixing of styles is neither in accordance with reason nor the beautiful examples of antiquity now remaining unto us. The tower of this church is square, with turrets at each angle running up, and finishing with small battlements. The lower part contains a deeply-recessed doorway, with bold shafts and mouldings. Above is a "*perpendicular*" window, which is somewhat disproportionately short. The clock, in the centre of a row of panelling, comes next, and then the belfry-window, of *decorated* character, being filled with flowing tracery. The upper part of the tower is finished with a profusion of graceful panelling, and terminated with perforated battlements of chaste design. The whole is exquisitely beautiful and picturesque; nor do I know any *modern* tower which has so fine an effect as this. Whether the sun shines broadly over its top, as it stands boldly out against the clear distant blue of the sky, or clouds chequer the face, the effect is equally beautiful, combining fair proportions with the chastest details. But there is, I think, one anachronism that, to an antiquarian eye, mars the whole: it is like the mole upon the fair face of some otherwise exquisitely beautiful girl. The lower window is of about the date of 1450, that of the upper one about 1370, and is copied, I suspect, from one in Worstead Church, Norfolk. Therefore, even if the tower were built to imitate different periods, which I can hardly imagine, they have placed the oldest style upon the top of the more modern one; so that an Irishman might blunder upon the idea, that they had commenced building at the top, and gradually travelled down to modern times. One has heard of "building castles in the air:" surely the architect of this edifice intended to illustrate the saying. The ground on which this edifice is built being much higher at one end than the other, the architect, by way of obtaining a level, has constructed a large and handsome flight of steps, though somewhat too high, at one end, occupying the whole width of the edifice. This gets over the difficulty; but, although this may be a beauty to a Grecian temple, which was always placed upon the uppermost of a flight of steps surrounding the building, it is inconsistent with this style of architecture, and but few examples remain of such, except here and there upon the continent. Of the interior, with much that is good, there is much that is indifferent: the details are often excellent in design, but poor in execution, not having sufficient boldness or projection. The cornice from which the roof springs, especially, is much too small, the bases of the piers are miserable, the shafts against the outer wall, supporting the aisle roof, are poor and thin; but yet, with all these defects, in consequence of the excellence of other parts, the absence of that great defect in Gothic architecture, side galleries, and the expense lavished upon the whole, there is an effect produced that is highly pleasing, and renders the *tout ensemble* of this edifice one of the finest of its kind in this county, if not in the country. The entrance gates are much too small and unimportant, and resemble the upper portions of pinnacles cut off and placed there, and are, besides, much too numerous. How much better would have been large, bold, and handsome piers, or arched gateways, than these expensive frittered pieces of gingerbread, which must, altogether, have cost many, many hundred pounds.

Few things more strike a stranger's notice, or give him a better idea of the wealth of this most wealthy town, than the number and excellence of the banking-houses. To offer remarks upon a very small number would extend these papers too far, but there are two just completed that may be worthy of notice, viz., the North and South Wales Bank and the Union Bank. The former is one of the handsomest in the town; but, in criticizing any architectural work, the critic should make himself acquainted with the peculiar circumstances under which the architect was placed, and endeavour to discover what control they exercised over his design. Upon a cursory examination of this bank, it is evident the architect had to contend with difficulties of no mean order, such as his ground being irregular in shape, and, also, the necessity of getting sufficient accommodation within a very confined space, thus compelling him to obtain in height what he wanted in superficies; and, yet, here are enormous difficulties overcome, and a handsome edifice, in conclusion, remains. The entrance front consists of a Corinthian portico, *in antis*; the columns, which are very rich and handsome, being just disengaged from the wall and set upon pedestals, the whole being surmounted by a pediment, with rich cornice, &c. There are, in the centre, a doorway and two windows, one above the other, but the ornaments of all these are inferior to the rest of the work. The side consists of a row of six pilasters and three tiers of

windows, the lowest range having three, circular-headed, with key-stones, the place of the other two being occupied by narrow doorways. This building is too high, the entrance too narrow, the doorways, columns, and pediment cramped; but, it is also evident, the architect had no control over these: it was the stern necessity, arising from want of space. This must also excuse the narrow doorways of the side, although it will not do so the swelled frieze over it, a licentious practice, made use of in few buildings of importance, except the Temple of Bacchus, near Rome, the Basilica of Antoninus, and afterwards by Palladio, in the Rotunda of Capra, and a very few others. The cornice of this building is remarkably fine, and, in the order of its mouldings, resembles those of the Temple of Jupiter Stator, in the Campo Vaccino, the whole of which is considered to be the finest specimen of the Corinthian order in the world. One regrets, that want of means, or some other cause, prevents the least exposed sides of this edifice being finished in the same style as the two principal fronts, thus preventing that unity so essential to classic beauty.

The Union Bank, corner of Fenwick-street and Brunswick-street, has just been completed, and, although it is but a small edifice, I regard it as one of the completest, of its size, in the town. The front has two chaste Ionic columns, *in antis*, upon a high plinth, surmounted by a pediment, in which are some very bold and admirable carvings, whilst the frieze that surrounds the edifice is ornamented by handsome carvings of flowers, honeysuckles, &c. The cornice is plain and good, and is surmounted by carved pedestals and handsome parapets. Under the portico, also, are some very handsome illustrative carvings in high relief. The side is plain, but chaste, the windows simple and original, and all the details excellent.

After viewing these and many other buildings of the same kind, I inquired for the edifice in which the branch portion of the business of the Bank of England is transacted in this town, naturally expecting an edifice worthy of this great establishment, the profits it is reaping in the town, and the spirit shown in the erection of so expensive a one in London. But what was my astonishment and disappointment on being shown a poor, little, paltry, pitiable place, in Hanover-street, where there is neither beauty outside nor sufficient space in; some places dark, and all botched, inconvenient, and defective! Surely, the leviathan of Threadneedle-street will not be outdone by the pettiest banking-house in Liverpool.

A stranger is also justly struck by the number, size, and excellence of the Market-places here. The Fish Market is admirably suited to its purposes, and the entrance to the Fish Hall presents a very quiet, plain portico, expressive of its object. The St. John's Market, which is, I believe, the largest in this county, has no external beauty, as it consists, in front, of a mere brick wall, with stone entrance archway, with a column on each side and entablature over them. But, upon entering, one who has never been there before is much struck with the width, height, and length, the span and construction of the open roof, which, by constant repetition, as the eye looks down the long perspective of distance, has a curious effect. There are fine, broad avenues, supported and divided by numerous tall, slender pillars, to the eye all trending to the same point in the extreme distance, affording a beautiful practical illusion of perspective, whilst the admirable mode of lighting it gives, at certain times during the day, when the sun is brightly shining through the windows, an aërial effect of light and shade, and, in the distance, a dim atmospheric effect, that have been often admired by artists. All this, with the fair faces and rich dresses that are to be seen there, on market mornings; the luscious display of apricots, peaches, and other fruits; the beautiful bunches of flowers, of every kind, opening their petals to the day, and spreading around a delightful perfume; with the coolness and shadyness of the place, and the clean appearance of the market women, so different from those of Birmingham, London, or elsewhere, renders it, though but a market, a place where the stranger may well spend an hour's stroll.

EDER.

(To be continued.)

ON THE STYLE OF INIGO JONES.

WE feel delight in reviewing the merits of a master, for as pupils of design we are interested in whatever concerns the history of our art: but we are more concerned in the criticism, when that master is an Englishman, and that art our countrys. There is another interest involved in the investigation; because in descanting on style, we too often pass over beauties and originalities, where the prevailing sentiment is evidently borrowed. There is a disposition about us, to wave that patient investigation of the detail, under which the independance even of the borrower appears. Thus we say, in allusion to Inigo Jones, that his style is Palladio's. Certainly, there is the same modification of the orders, and the same appropriation of effect, perhaps the same selection of the parts. Certainly his style is Palladio's, if we except that, upon which the very groundwork of the Italian reposes; viz. the skill of assorting and applying, materials already furnished. But then, he extracts no more from Palladio, than the poet does from nature, namely the elements and the matter. Indebted to Palladio he is, as the poet is to nature, for the picture displayed, but indebted he is also, to his own exquisite perception, for the soul which can encompass, and the hand which can pencil anew, its beauties in fresh combinations. He does not merely either leave Palladio full of the impressions of that master, but betrays the critic too: arrested by the elements, as much as by the effect by the parts, as much as by the whole. Such and such only, is the connection of the English master with the Italian; and if the latter deserve the homage of the southern school, so also does the former merit the praises of the northern. And if Palladio be recognized as the father of combinations, so should Jones be seen original in his conceits; whilst both appear like distinct genuises of music; making the instrument of design to arrest the mind, solely by the exquisite beauty of their creations.

To follow Inigo Jones however in his arrangement, let us take him in one of his grandest flights, where the combinations are most extended, and the distribution most difficult. Suppose the front of 720 feet in the design for the Whitehall Palace. To distribute so long a front, and to bestow upon it the necessary gradations in effect, required several vast features in the first place: so the wings and the centre are made distinct, in plan, profile and elevation. The centre being the abode of dignity, and a focus for the eye, this is elevated above that contiguous to it: the wings too are elevated, and here the variety is first in the proportion, with the regulating principle an increase of the parts as they distance from the eye. For had not a tower terminated the façade, the eye would have fallen, and had not shadows been cast from the wings, tameness and indistinct blending might have resulted. Having resolved on general distinctions, Inigo Jones appears on a more intricate field, and here it is more important to follow him, since here it is he rises above, and surpasses his imitators.

First let us approach the centre, which though varying from others of his design, illustrates, the peculiar artifices of his style. It is not enough, be it observed, that the rusticated base which extends throughout, should here be stopped; and that pedestals and their huger columns should rise, unbroken by an inferior part to the first cornice. There is a fresh arrangement of variety yet to be considered. The centre betrays infinite attention and careful study. He seems here to have so diffused his features, that considered in itself and isolated from the main building, it would yet betray an unity in its design: unlike many of his followers who scatter their unity throughout the whole. Although the heighth of the centre is very little more than its width, the eye is yet insensibly led upwards to the tympanum which crowns it: and this not so much from the existence of that tympanum, as from the minutiæ. Nothing flat or depressed intrudes, the eye sweeps upon the arched entrance to the arched window above; and from the arched window to the figures which recline thereon. The angle made by those figures would meet in the base of the shield; whilst from the shield you at once forsake for the statue. Another glance however and fresh contrivances appear. The side compartments of the centre, in obedience to the idea of a pyramid which seems to float in Jones's mind, must not conduct you too hastily to the apex; because if so the principle of pyramidal truth would vanish. To avoid this error then, and yet still to admit of that gradual tapering, which in a pyramid is regular and unbroken, from the base to the summit; he has contrived in the side entrances, that their arches should conduct the eye, not to the tympanum, that would be sudden; but to the crown of the grand central arch: for if a line be drawn from the springing of the lesser arches to their crown; they would intersect in the crown of the greater arch. Then again, as if afraid that this were too sudden an ascent of line so near the base, he introduces two square panels over the lesser arches, as a relief to restore the balance, as it were of form. On the upper story the same idea exists, and the intersecting line of the lesser tympanums is in the centre of the head from which a festoon of flowers droop. A further scrutiny might still reveal increasing artifice in composition, but enough has been said for the merits of the centre. It will appear evident, I humbly believe as the criticism proceeds, that Jones surpasses all his imitators in that attention to the subordinate parts of his edifice. And this, be it remarked, is no trivial allowance to make, when the very elements and basis of Palladian doctrine, is combination; and that not in mere generalaties, but in every part where consistency will admit a feature. Leaving the centre for the void, contiguous to it, there appears nothing peculiar to him from the rest of his school. The piers between the windows are twice the windows' width, whilst the windows are twice their height. The effect of this part, and its sober appearance is more to be considered in connection with the edifice as a whole, than as in-

dividually remarkable: except we notice the ornaments over each pier on the crowning blocking course; and which directing the eye upwards forms for it a kind of imaginary pyramid with each pier, whose ideal base is level with the top of the upper window. Advancing towards the wing, a part appears, contrasted with the void, from its heavy masonry, and then again relieved by its columns and statues. Here again the eye is courted centrally—(as if afraid that it might grow weary and fall) by its travel along the front. Four columns only are crowned with statues; the central window only have bullusters, whilst the roof slightly rises, to assist. Whilst here too the ornament, appears more abundant, and the superficies more enriched. The windows are richer, their dressings less plain. Trusses occur, breaks obtrude, and a bullustrade surmounts. Once more hasten on, and the wing salutes you, in its similarity to the centre, you admire the contrivance of Inigo Jones to protect the unity of this vast front. There you encounter a principle of optics though differently applied. The increased distance of the wing from the centre, exacts and increased importance in its composition, and proportionate to that distance, to recover the unity. It is made somewhat to resemble the centre, in its minutiæ, and thus the link of harmony is connected.

Looking back once more at the façade as a whole, we recognise a hand overcoming, rather than overcome by, the materials of his art. The perspective is also worthy of his notice, so that in whatever way you regard the edifice, its vast proportions and its more elegant reliefs are exposed to view. In the long and difficult front it is, that Inigo Jones is more marked and peculiar. That complication of parts, that ever varying distribution of the features, are peculiarly his. Others may appear on a smaller field equally happy, and yet cannot approach him in the grand and more extended scale. Like true genius he seems increasing in beauty and effect, with the increasing necessities; and extended nature of the design. As spectator of the structure, you are pleased as much by the intricacy unravelled as by the variety subdued. Nature with him is ever found under veil of art. But he is the painter of its gayer effects, whilst others on the contrary, represent its more sober appearances. If you take a critical survey of his designs you discover first the sketch, the outline and the shadows: and in this only *equal* to his school. But as a Watteau and Ostade gather a name from grouping the same figures, which otherwise exhibited were poor and tame, so Inigo Jones, by a consummate skill in assorting his, stamps his name upon the edifice. With the same cornice, architrave, ballustrade, figures and pediment, as others employ, a very different arrangement appears. If his front be short, you see this more particularly. He destroys the stiffness of outline by the detail. His decorations are sometimes sweeping and reclining in their form; and it was a desire to avoid the rigid line in ornament, that taught him to break the tympanum for the introduction of a wreath or a shield. If the wings are raised (which with him is usual when the centre is much depressed and the main body of the building long), he seeks to relieve, by a depression of form (very frequently) in the decoration. The architrave sometimes sweeps into width towards the base, as in the wing of Wilton House. He seldom employs one uniform unbroken ballustrade in the middle part, along the whole length, unless there has been a paucity of reliefs below. In Wilton House too we see this. If however the front be long, and the design a mansion, the various *parts* assume the varied forms, and together with the detail unite their effect; the various points of the building in this case assume an inclination in form as they soar up and encounter the sky. That is, they exhibit no harshness in their outline, or very little. He seems to unite with Wren in opinion and taste, and to mould the figures into spheres and sweeps as they stand against the sky. It is this which regulates him even in the ballustrade vases and globes that crown the cornice. It is something of this which directed a pediment on the wings of Wilton House, for it leads the eye in breadth, as a balance to the loftiness of the wing, and avoids the harshness of the horizontal. It may be admitted that this disrelish for harshness often led him into extravagance in composition, and caused him to exhibit in his smaller studies, a richness and exuberance more fitted for an interior. It may be admitted too that a certain want of severity in taste and coolness in adjustment, led him to trespass beyound what his more careful rival Burlington dared to allow. Often he may appear omitting the necessary members from a cornice, omitting the frieze, and introducing double plinths; still that richness of the artist, snatched from Italy is a charm entirely his own. In conclusion, it must be allowed, that Inigo Jones, gives a finish both picturesque and lively to the building, and brings into his design not only the orders and sentiment of Palladio, but the creations of an active fancy and the richest pictures of ideal taste.

FREDERICK EAST.

December, 1840.

ON THE RELATION OF HORSE POWER TO TONNAGE IN STEAM VESSELS.

SIR—It is a disputed question whether a large or small horse power of engines, is best adapted for sea-going steam vessels.

Without entering into the discussion, I will lay before your readers the tonnage and power of some of the finest ocean steam ships yet built; which table shows some curious contrarieties.

Vessels name.	Tonnage.	Horse Power.	Proportion of tonnage to power.	Remarks.
			Tons.	
*Acadia†	1200	440	1 h. p. = 2¾	Exceedingly fast.
*Oriental	1670	440	1 4	10¾ knots when deep.
*Great Western	1340	450	1 3	
*Great Liverpool	1543	464	1 3⅓	
British Queen	2016	500	1 4	Fast when light, and light stern breeze.
President	2366	540	1 4⅓	Slow under any circumstances
*Liverpool (before alterations)	1150	404	1 2¾	Slow and crank.

In the above table I have endeavoured to place the vessels in the order of speed—an average westerly passage across the Atlantic being supposed to be the work performed. The "Oriental" and "Great Western" are, I think, about equal—as also the "President" and "Liverpool" (before alterations).

It will be observed that though the proportion is the same both in the "Oriental" and "British Queen," yet it cannot be questioned that on every point, and most especially when the vessels are deep, the "Oriental" has the advantage.

It may also be mentioned that the "Liverpool" has had seven feet more beam given her, and is now 393 tons larger than formerly; the proportion of power has, therefore, been *decreased*, whilst her speed and weatherly qualities have been materially *increased*.

Also, the four first and best vessels, and which vary least in their speed, in bad weather, have more beam (in proportion to their length) than the other three.

It appears to me that more depends on *the form and construction of the vessel*, than on having a large engine power.

I am, &c.

E.

Manchester, *Nov.* 30, 1840.

TABLE OF PORTICOES.

SIR—Mr. Dyer has pointed out what certainly looks like a very stupid blunder in the Table of Porticoes from the Penny Cyclopædia, and I was at first rather alarmed by his note, for he says that the portico of the Victoria Rooms is therein stated to have five intercolumniations (intercolumns), although placed in the octastyle class. But, on turning to the table itself, I find he has misconceived what is said in regard to that portico in the column of remarks, where it is further described as being "unequal diprostyle, recessed, five intercolumns," that is, recessed within for the space of five intercolumns, or corresponding with five out of the seven intercolumns of the octastyle in front. Perhaps the sense would have been clearer had the comma after "recessed," been omitted, or had "for" been substituted instead of it. But brevity was indispensable; and, in fact, that portion of the table was considerably abridged after being set up, in order to get rid of many *turn-overs*, and reduce it almost entirely to single lines. And thus it happened that the words "sculptured pediment," which were in the first proof, were struck out in order to save a second line. Other remarks underwent similar curtailment in several instances, for else the table would have occupied an entire page of the Cyclopædia. So far, however, from complaining of this, I rather feel grateful for so much space, and so many illustrative wood-cuts, being afforded me in that publication for such an article: because, although both fell far short of what I should have taken, had I been left entirely to myself, they exceeded what I could reasonably expect.

* In these five vessels the variation of horses' power is only 24: the difference of tonnage 520!

† The remarks on the "Acadia" equally apply to her sister vessels, the "Britannia," "Caledonia," and "Columbia"; and constitute a good example, as little difference is found in their performances, all the four being remarkably speedy vessels.

Mr. Dyer's note has afforded me an opportunity of explaining these circumstances, and accounting for, what I admit to be, undue brevity and obscurity in the column of remarks in the table. Whether he has seen only that portion of the article PORTICO in the Cyclopædia, I know not; neither do I know how he relishes the terms I have ventured to coin. Perhaps not at all; at least he has employed one term in a sense which I hold to be grossly solecistical and contrary to analogy, namely "*intercolumniations*," instead of "intercolumns"; since the former term does not admit of a plural meaning, because it does not refer to the separate spaces or intervals between the columns, but merely the general arrangement, accordingly as the columns are put closer to, or further apart from each other. We therefore employ the first word very properly, when, with reference to that circumstance, we speak of the intercolumniation in a portico, &c., as being compact (*pycnostyle*), or straggling (*aræostyle*); but we should say "the centre *intercolumn* is wider than the rest;" or "there are seven *intercolumns*," and so on; for in such cases the other term is nonsense, and we might as well talk of a portico having eight or any other number of *columniations* instead of so many *columns*. Surely architects ought to know English well enough to feel the distinction at once; yet as a great many of them, it seems, do not, that must be my excuse for dwelling so long upon that little *lapsus linguæ*.

I remain, &c.,

L.

J. CROKER'S HINT TO THE SOCIETY OF BRITISH ARTISTS.

(IN A LETTER TO THE EDITOR.)

SIR—In noticing the Exhibitions at the Royal Academy, other publications besides your own have animadverted upon the very inadequate space there afforded to architectural drawings, in consequence of which, not only a great many are rejected every season, but of those admitted the majority are so hung up that they cannot possibly be examined, or even looked at all with any degree of comfort; accordingly those so placed are in danger of being altogether overlooked, let their merit be what it may. If the evil admits of no remedy nor mitigation—which, I for one, do not believe—complaint and remonstrance are of course useless. What surprises me, however, is to find that the Society of British Artists should not have had *nous* enough to take advantage of this circumstance, which they might easily enough convert to a trump card of their own. Surely it would be far better policy on their part, instead of entirely shutting up one of their rooms, as they have done for the two last seasons, to devote that room—which I should take to be quite as large as the one at the Academy—entirely to Architectural Drawings, and invite the profession (by public advertisement) to contribute designs. They might not perhaps be able to *fill* it—to get together such a *squeeze* of frames, as we invariably find in in the Architectural Room of the *Royalists*; yet that I conceive would be a very great recommendation rather than the contrary; and many—not the lowest of all in talent—would, it may be presumed, prefer the chance of a favourable situation in Suffolk-street, to the risk of being either turned out altogether from the building in Trafalgar-square, or else seeing their drawings hung up, where very few would be at the trouble of looking at them at all.

Nevertheless, I have been informed, upon most unquestionable authority, that the plan here suggested has been actually submitted to the council, by one of the members, and was thrown out almost *nem. con.* and without any *con*-sideration! Upon what grounds it is difficult to guess, for I believe no argument was attempted to be brought against it, except the most perverse and negative one, that it would do them—*i. e.* the painters—and their exhibition, no good whatever. Was there ever such grovelling, narrow-minded stupidity! Even granting that it would not render their exhibition more attractive, it could not possibly tend to make it less so. Those who did not care to look at such drawings would not be compelled to enter that particular room against their inclination. Neither would the addition of architectural drawings detract from their treasury: on the contrary, it might perhaps serve to draw a few more shillings into it. At all events the experiment would cost nothing—except, perhaps the printing one or two more pages in their catalogue,—and should it turn out quite a failure, they might then abandon the plan for the future. But until such proof be afforded, I will not believe that it would prove one: so far from it that I am of opinion the public generally would learn by degrees to take an interest in architectural designs and drawings by frequently seeing them: an opinion in which I am confirmed by a remark which Heinz makes in his notice of the architectural subjects at the Paris exhibition this year. After observing how desirable it is that the designs for all buildings of importance should be publicly exhibited beforehand;—that considerable interest is thereby excited, and that critical remark and discussion are elicited, he continues thus: "It is idle to assert, by way of objection, that the public generally do not understand or relish architectural drawings: such argument will not hold water, when drawings of that kind are as beautifully executed as most of those in this exhibition. We had positive proof to the contrary, for we observed many even of the lower orders examining and apparently both understanding and gratified by them—even those which were sections. *Only afford the public the opportunity of seeing and becoming acquainted with architectural drawings, and they will very soon learn to understand them.*"

I make no further comment on this than to remark, that it is to be presumed the same might be the case here, unless, indeed it should be urged that English people are so very much more stupid than French people, that the latter country is no rule whatever for our own.—With respect to the British Artists and their enlightened Council, I leave them to chew the cud on what I have said. Neither I nor any one else can compel them to have common sense, if they are determined to have nothing to do with it. There is a saying which informs us that 'though one man can lead a horse to water, not ten men can make him drink:'—and so, I suppose, it must be with them; they will not swallow my prescription. Therefore, having sent you this epistle as a New Year's gift, I now take my leave, remaining,

Your's, with a Thousand Et-cæteras,

JOHN CROKER.

TABLES FOR RAILWAY CURVES.

SIR—Having heard much controversy between writers of scientific works, relative to the best mode of laying out segments of circles, whereby the prescribed limits of almost all lines of railway, render it, in the majority of cases, necessary to substitute curves of various radii; and I think several of your correspondents have not given the formula in a manner sufficiently comprehensive for general purposes. Having had frequent opportunities of determining curves upon several public works for some years, none yet appearstome so ably adapted, to all capacities, as the method you have set forth in the first number of your Journal for 1840, as to the accuracy of which I can testify, from having repeatedly put it into practice upon ground of no ordinary character.

I am, Sir,

Folkestone, Your obedient servant,

16*th Dec.*, 1840. WILLIAM DODD.

Substitute for Tinning.—We have witnessed several interesting experiments calculated to test the success of an important discovery in the art of manufacturing cast-iron cooking vessels, by Messrs. T. and C. Clarke, the extensive iron-founders of Wolverhampton. English manufacturers of articles technically denominated "hollow ware," have for many years been sorely puzzled concerning an ingenious and beautiful method, practised in Germany, of lining iron culinary utensils with a smooth white enamel, resembling porcelain, which far surpasses, in point of cleanliness and durability, the English system of "tinning" the interior surface. Indeed, so desirable has this art been considered by our countrymen that, with their usual enterprise, considerable sums of money, and a most liberal expenditure of time and talent, have been for many years employed in seeking to discover the process. Until the present instance, however, every effort proved fruitless. Several of our manufacturers, it is true, have contrived to line the vessels with an enamel equal or superior in appearance to that of the foreign article; but this enamel cracked, chipped, and would not stand the fire; and the grand secret, which, of course, is the production of an enamel which shall so expand and contract with the metal as not to chip or crack, remained as much unknown as ever. Messrs. T. and C. Clarke, however, have at length most perfectly succeeded, and having, of course, secured a patent, are now manufacturing an article in every way superior to that of their Continental rivals. The manufacturers of British hollow ware have always surpassed those of Germany in the lightness and elegance of their castings, so that Messrs. Clarke are enabled to add this advantage to that of at least equal excellence of enamel. The German enamel is found to wear as long as the iron vessel itself, but we believe it will scarcely stand the severe test to which we have seen Messrs. Clarke's article subjected—viz., that of heating an enamelled saucepan to a white heat, and then plunging it suddenly into cold water, until cooled, without either the vessel cracking or the enamel being damaged or discoloured. Another experiment consisted in placing one of the vessels filled with water upon a large fire, and allowing it to remain until the water had completely boiled away, and for some minutes afterwards, without in the slightest degree injuring the vessel or its enamel. The great importance of the application of this discovery to our own manufactures is, that the hollow-ware manufactured in this country may be purchased at less than half the price of that imported from the Continent.—*Staffordshire Examiner.*

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS.

"*On the Action of Steam as a Moving Power in the Cornish Single Pumping Engine.*" By Josiah Parkes, M. Inst. C. E.

(*Continued from page 426, Vol. III.*)

Mr. WickstEED being called upon by the President, declined at present giving an opinion upon the theory before the meeting. He stated, that he was still trying experiments upon the engine at Old Ford—that the results up to the present time were in accordance with his anticipations—that, with small screenings of Newcastle coals, the duty of the engine amounted generally to 75 millions, and sometimes to as much as 81 or 82 millions. He thought that 7 ℔. per square inch for friction and imperfect vacuum was too large an allowance for an engine of the size of that at Old Ford, as, when the speed was 10 or 11 strokes per minute, the power was equal to 200 horses, and, if an allowance of 6 or 7 ℔. was made, it would be equal to 100 horses' extra power, which he felt certain could not be correct. At the same time, he believed that in very small engines the amount of friction, &c., might be correctly estimated at 6 or 7 ℔. per square inch. He had also tried some experiments upon a Boulton and Watt low-pressure engine: by the introduction of Harvey and West's patent pump valves, the duty of the engine had been increased from about 28½ to 32¼ millions. He was now trying experiments on clothing the cylinder, &c., and with steam in and out of the jacket: the result of all these experiments should be laid before the Institution as soon as they were completed.

Mr. Seaward considered the paper to be very valuable, as opening a new view of the action of steam, and inducing discussion and experiment; but he was not prepared to allow at once the percussive action, nor could he admit it to be the cause of the increased duty, as, if so, an augmentation of pressure in the boiler would give a corresponding increase of duty. Engines were worked at all pressures up to 60 ℔., and even higher; but it was not perceived that the highest pressure gave the best results. He attributed the increase of duty to an improvement in the manner of using coal under the boilers; to the use of good non-conducting substances for clothing the cylinders, steam-pipes, &c., to prevent the radiation of heat; and to the general improvement in the construction of the valves and other parts of the engines, the proper dimensions for which were at present better defined. The expansive principle did not seem to have operated so well in the rotary as in the pumping engines. He had not hitherto credited the statements of engines working with a consumption of coal of 5 ℔. per horse power per hour, nor of the great advantage of the use of steam at high pressures. Several Scotch boats had been worked with steam, at a pressure of 33 ℔. on the inch, without any corresponding advantage. The increase of duty, then, he attributed to other reasons than the effects of percussion, as, independent of other considerations, the steam must always have possessed the same percussive force, which it must have exercised without producing the effects now attributed to it.

Mr. Wicksteed observed, that there were many reasons why the duty of the double expansive engines in Cornwall was not in proportion to that of the single pumping engines. The introduction of the former only dated from about the year 1834; but few had been made; there had not been the same amount of experience to guide the engineer in their construction; they were of small size, and consequently the amount of the friction was greater in proportion than in the large single pumping engines. Notwithstanding all these disadvantages, the duty had increased from 15 or 20 millions to 57 millions. It had been stated that the double expansive engines constructed by Hall and by Penn did not consume more than 5 ℔. of coal per horse power per hour; while the ordinary low-pressure double engines required from 8 ℔. to 10 ℔. of coals. He would suggest to such members as possessed the power of verifying this fact to communicate their observations to the Institution.

Mr. Rendel would direct the attention of members to the main feature of Mr. Parkes's paper, which was the discovery of the action of a percussive force by the steam. The full investigation of this subject deeply interested the scientific world; and it was important that its merit should be clearly displayed. If any power could be gained from the percussive action, the more suddenly the steam could be admitted upon the piston, the more advantageous would be the result. It would be interesting to learn whether, in the changes in Cornish engines, from which such improved duty had resulted, any increased area had been given to the steam pipes and valves, and to what extent as compared with the old practice. If any change of this kind should be found to have taken place, it would be an argument in favour of the percussive principle.

Mr. Field expressed his sense of the obligations which the Institution owed to Mr. Parkes for having taken up this subject. It had been supposed by many persons that, independently of the economy arising from clothing the cylinder, jacket, and boilers, and the expansive action of the steam, some other cause might have assisted in producing the increase of effect in the Cornish engine. Doubtless, much had been done to economise heat and steam by the slow combustion of the fuel under the boilers, by diminishing radiation, and by expansive action. Nevertheless, the question to be solved was, Can these improvements account for the whole progressive advance in the duty from 40 or 50 to 90 millions? He trusted that Mr. Wicksteed would apply the indicator to his engine, and ascertain the pressure on the piston at every portion of the stroke.

Mr. Parkes remarked, that many observing men had conceived doubts of the sufficiency of the commonly-received theory of expansion to explain the excessive economy of the Cornish above the unexpansive engine. Some had recorded this opinion. Mr. Henwood found the steam's force in the Huel Towan engine unable to sustain the water-load alone. Messrs. Lean showed a similar deficiency of steam power in an engine at the United Mines; and Mr. G. H. Palmer was perfectly correct in his statement, that the absolute force of steam as commonly appreciated was inadequate to the performances assigned to it; but he was wrong in asserting that these effects had not been obtained, for they were indubitable.

As doubts had been expressed with regard to the accuracy and sufficient duration of the experiments selected as the basis of his analysis, he would state, that Mr. Henwood obtained the quantity of water consumed as steam, during a continuous observation of twenty-four hours, having previously measured the water discharged by a given number of strokes of the feed pump, and then counting the entire number of strokes made to supply the boilers during the experiment. The pump was used periodically, and its whole contents injected into the boilers at each stroke, so that no material error could arise as to the quantity of water consumed as steam. With respect to the resistance overcome, Mr. Henwood several times measured the whole height of the lifts in the most careful manner, not comprehending the fact of the steam's force being unequal to sustain the load of water alone. Not content with this, he measured the water discharged by the pumps, and found a near correspondence with the calculated quantity.

Mr. Parkes would prefer a short experiment on the consumption of water as steam to a long one, as more likely to be accurate. He had rejected the eight months' experiment on the United Mines engine, as being unsuitable for the purpose of his investigation; for, during so long a period, the boilers must have been several times emptied and cleaned, stoppages must have occurred, condensation, leakage, and other circumstances must also have taken place, which unfitted that experiment for analysis. Long experiments were the best for the practical determination of the duty done by coal; but the action of steam in performing that duty was altogether a separate consideration. The consumption of water as steam for a single stroke of the engine, if it could be obtained, would be all-sufficient for investigating its action in the cylinder, as the weight raised by a Cornish engine must be the same at every stroke. If any error existed in the statement of the wated evaporated, it was more likely to be in excess than in deficiency; for it would be admitted that the conversion of 10½ ℔. of water into steam, by 1 ℔. of coal was not a common occurrence. Yet, granting this result to have been obtained, it appeared that there was not steam enough to overcome the resistance. Such was the result of the analysis of the Huel Towan and Fowey Consols engines, for which the evaporation was ascertained; and if less water had been converted into steam, the deficiency of power, compared with the effect, would necessarily have been still greater. Mr. Henwood's statement of the performance of the Huel Towan engine was confirmed by a previous trial of the same engine in 1828, conducted by a committee of twenty-one competent persons, when it appeared, after twenty-six hours' experiments, that 87,209,662 ℔. had been raised one foot by a bushel of coals. Mr. Henwood's experiment gave 81,398,900 ℔., so that in the analysis the lowest result was used.

It had been urged, that if any such force as percussion belonged to steam now, it always formed one of its properties. This was true; but it either may not have been well applied, or its effect not detected. The expenditure of power as derived from the quantity of water consumed as steam could not be determined so long as any condensation of steam took place in the cylinder; for whatever steam was there condensed had lost its power. The perfect clothing of the Cornish cylinders rendered the analysis of the action derived from a given quantity of water as steam nearly free from error.

Mr. Wicksteed had stated, that when he kept the steam out of the jacket of one of Boulton and Watt's engines, it required full steam throughout the stroke to overcome the load; whereas, with steam in the jacket, some expansion could be used. This would show a greater expenditure of power in one case to produce an equal effect. Such, however, could not be: an equal power operated in both cases; but in the one, a portion of it was annihilated, or had produced no useful effect.

Mr. Parkes considered it as demonstrated, that a force, independent of the steam's simple elastic force within the cylinder, did operate in the Cornish engines. The term *percussion* might be objected to when applied to an elastic fluid. Nevertheless, he conceived that the instantaneous action transmitted to the piston, on the sudden and free communication effected between the cylinder and boiler, must produce an effect analogous to the percussion of solids. He considered the proofs of such action adduced in his paper as irresistible.

He would ask how it could be accounted for that the steam was in a state of expansion during 19 out of 20 parts of the stroke in the Huel Towan engine, as shown by the indicator diagram, though it was freely admitted during one-fifth of the stroke, unless a velocity had been given to the piston by an initial force exceeding that of the steam's simple elastic force? How was it that, at the end of the stroke, the steam's elasticity was able to sustain so small a portion of the load in equilibrio, unless a momentum had been transferred to the mass by the impact on the piston, and aided the expanding steam to complete the stroke, which alone it was incompetent to perform?

The greater degree of attenuation in which the steam was found on the completion of the stroke in one engine than in another, compared with the pressure of the resistance, and with the amount of expansion determined by the period of closing the valve, alone proved that the ordinary theory was inadequate to explain the action of steam in these engines.

He had for some time conjectured that a hidden and unsuspected cause influenced the performance of the Cornish engine; and if he had not been successful in discovering its nature, he considered the analysis as placing the fact beyond question, that the quantity of action resulting from the steam admitted into the cylinder was much below the force of the resistance opposed to it, and overcome.

June 23.—The PRESIDENT in the Chair.

John Frederick Bateman was balloted for and elected a member.

"*On the Stamping Engines in Cornwall.*" By John Samuel Enys, A. Inst. C. E.

The process of stamping or reducing the ores of tin in Cornwall, by means of iron stamp-heads, which crush the ore in falling upon it, was formerly effected in mills worked by water power. These have been, from economical and other reasons, for the most part superseded by the use of steam; and even with inferior engines, the result has been such as to enable the poorer portions of the lode (which were frequently left in the mine) to be now advantageously worked.

The work performed by the stamping engines was reported with that of the pumping engines, and showed the duty to be from 16 to 25 million lb. raised one foot high by one bushel of coal, as estimated from the actual weight of the stamp-heads. The engines appropriated for this purpose were generally old double-acting engines of inferior character, and not unfrequently in a bad state of repair. The use of expansive steam was tried with good effect upon them, and induced Mr. James Sims to build an engine calculated more fully to develop the advantages of this principle. He accordingly, in the year 1835, erected one at the Charlestown mines. It was a single-acting engine, communicating the movement direct to the cam shaft for lifting the stampers without the intervention of wheel-work. The first reported duty, in December, 1835, was 43 millions, which was two-fifths more than had previously been performed by stamping engines. Subsequently, Mr. Sims erected other engines of similar construction, and from them may be taken the reported duty in April, 1840:—

Charlestown Mines . .	59,589,884 lb.
Carn Brae . . .	57,611,073
Wheal Kesley . . .	58,748,452

This increased duty induced other engineers to turn their attention to the subject, and they have constructed engines which equal these duties; the chief variation being the adoption of double action, which seems generally to be preferred.

This paper is accompanied by four drawings of the Carn Brae stamping engine, by Mr. Sims, junior, showing in great detail the construction of the engine and the stamping machinery.

"*On the Effects of the Worm on Kyanized Timber exposed to the action of Sea Water, and on the use of Greenheart Timber from Demerara, in the same situations.*" By J. B. Hartley, M. Inst. C.E.

There are probably few ports in England where the inconvenience resulting from the attacks of marine worms (*Teredo navalis*) on the timber of the dock gates and other works exposed to their action, is more severely felt than at Liverpool. The river Mersey has a vertical rise of tide of 27 feet at spring, and 13 feet at neap tides, and the stream being densely charged with silt, a considerable deposit takes place in the open basins, and to some extent in the docks. The latter are cleansed by means of a dredging machine, but the former are usually "scuttled," for which purpose sewers connected with the docks surround the basins, having several openings furnished with "clows," or paddles, so that the rush of water from the docks may be applied for clearing away the mud from any particular part of the basin. The security of these paddles is, therefore, of the greatest importance, as the failure of one of them might, by allowing a dock to be suddenly emptied, cause great damage to the shipping. These paddles have been usually constructed of English oak or elm, and being much exposed, they suffer from the attacks of the worms. Cast iron paddles have been tried; but in consequence of the rapidity of the corrosive action, they soon became leaky, and were abandoned. Kyanized oak timber has been tried on the back of these paddles, and found to be perforated by the worm in the same time as unprepared wood. Some oak planks, two inches and a half thick, Kyanized at the Company's yard, were used on the west entrance gates of the Clarence Half-tide Basin, and in 14 months were completely destroyed. Several similar instances of the non-efficiency of the Kyanized timber are given; and the author proceeds to designate the timber which resists best in such situations. He considers that teak is less liable to injury than English woods, and instances the inner gates of the Clarence dock, which have been built for 10 years, and at present are but slightly attacked.

The timber which he prefers for dock works is the Greenheart. It is imported from Demerara, in logs of 12 to 16 inches square by 25 to 40 feet long, and costs about seven shillings per cubic foot. Of its power to resist the attacks of worms, he gives many proofs: one of them may be cited. At the first construction of the Brunswick Half-tide basin, several elm clows were placed at the west entrance; these were destroyed by the worms in two years, and were replaced by others made of greenheart; the joints of the plank being tongued with deal, to render them completely water-tight. These clows have now been down about seven years, and, although the deal tongueing has been destroyed by the worms, the greenheart planking remains untouched and perfectly sound.

Many methods of protecting common timber have been tried; but the only successful ones adduced are—1st, the use of broad-headed metallic nails driven nearly close to each other into the heads and heels of the gates, but if driven an inch apart, the worm penetrates between them; and 2ndly, steeping the timber in a strong solution of sulphate of copper from the Parys copper mines in Anglesea. Some paddles made of English elm thus prepared had been in use upwards of three years, and, on an examination, were found to be very slightly injured; while the unprepared timber about them was quite destroyed.

The author observes, that the outer gates of the wet basins are most injured by the worm, from the sills being low down, and the change of water every tide assisting the growth of the worm. Those parts of the gates which are alternately wet and dry are more injured by the worm than the parts immersed always in the same depth of water. At the spot where a leak occurs from a bad joint, a defect in the caulking, or other cause, the worm commences its attack; so that the most incessant attention is required. Those basins into which the sewers of the town discharge themselves are comparatively free from the worm, from which it would appear that sulphuretted hydrogen gas acts in some measure as a protection against the attacks of the worm.

"*An account of the actual state of the Works at the Thames Tunnel (June 23, 1840).*" By M. I. Brunel, M. Inst. C. E.

In consequence of local opposition, the works have not advanced much since the month of March, 1840; but, as that has been overcome, and facilities granted by the city, the works will be speedily resumed, and the shaft on the north bank commenced.

The progress of the Tunnel in the last year has been, within one foot, equal to that made in the three preceding years. During those periods collectively, the extent of the Tunnel excavated was 250 ft. 6 in., and during the last year the excavation has been 249 ft. 6 in. This progress has been made in spite of the difficulties caused by the frequent depressions of the bed of the river. These have been so extensive, that in the course of 28 lineal feet of Tunnel, the quantity of ground thrown upon the bed of the river, to make up for the displacement, in the deepest part of the stream, has been *ten times* that of the excavation, although the space of the excavation itself is completely replaced by the brick structure. On one occasion the ground subsided, in the course of a few minutes, to the extent of 13 feet in depth over an area of 30 feet in diameter, without causing any increased influx of water to the works of the Tunnel. The results now recorded confirm Mr. Brunel in his opinion of the efficiency of his original plan, which is "to press equally against the ground all over the area of the face, whatever may be the nature of the ground through which the excavation is being carried." The sides and top are naturally protected; but the face depends wholly for support upon the poling boards and screws. The displacement of one board by the pressure of the ground might be attended with disastrous consequences; no deviation therefore from the safe plan should be permitted.

The paper is accompanied by a plan, showing the progress made at different periods. It is stated that a full and complete record of all the occurrences which have taken place during the progress has been kept, so as to supply information to enable others to avert many of the difficulties encountered by Mr. Brunel in this bold yet successful undertaking.

June 30.—HENRY ROBINSON PALMER, V.P., in the Chair.

"*Description of an Instrument for describing the Profile of Roads.*" By Henry Chapman, G. Inst. C. E.

The object of the author in the invention of this instrument was to facilitate the mode of making a preliminary survey for railways by a machine of a simple construction, and composed of very few moving parts. It may be thus briefly described:—

A light frame with springs and upon four wheels carries the machinery, to which a rotary movement is communicated from one of the wheels, which is keyed fast upon its axle. A double-threaded screw and a series of wheels work give motion to a cylinder, upon which a length of paper is coiled; this cylinder revolves, and moves simultaneously in the direction of its axis. A pencil, which moves parallel to the axis of the cylinder, marks a line upon it, with a velocity varying according to the inclination of the road, and is so arranged, that when the machine is passing along a level, the motion of the pencil will equal that of the cylinder. In ascending inclined planes, it will be retarded, and in descending it will be accelerated. By these means a rising or falling line will be accurately drawn. This variation in the action of the pencil is accomplished by means of a friction-wheel working against a cone, the different diameters of which regulate and determine the speed. The position of the friction-wheel upon the cone is determined by the change of position of a pendulum vibrating within a case which is filled with a dense fluid, for the purpose of rendering its action more uniform.

The machine will trace a section of a road in lengths of five miles upon each sheet of paper, to a horizontal scale of 20 chains per mile, and to a vertical scale of 200 feet to an inch. That no inconvenience may be felt from the smallness of the scale, the instrument is furnished with scales with sliding verniers, from which memoranda can be made of the distance run, and of the

variations above or below the datum line. These memoranda are made upon a strip of paper, which is fastened on a table, along which an index travels at a velocity corresponding with that of the paper on the cylinder; so that the strip of paper being afterwards laid upon the section, the points marked may be squared down without using the scales.

When the distance of five miles is passed over, a bell gives notice of the working machinery being disengaged; the section is removed, a fresh sheet of paper is introduced, and, as the pencil maintains its position, the section will be carried on continuously.

This communication is accompanied by three working drawings, showing, on a large scale, the machine in action, and all the component parts in great detail.

"*On the Efflux of Gaseous Fluids under pressure.*" By Charles Hood, F.R.A.S., &c.

The theoretical determination of the velocity with which gaseous fluids are discharged through tubes and apertures, has frequently been investigated by mathematicians; and as the question is one of importance in various branches of practical science, the author examines the several theorems which have been proposed for its elucidation, and compares them with the results obtained by experimental researches.

Dr. Papin, in 1686, appears to have first ascertained the law of efflux to be the same for both elastic and inelastic fluids, and the majority of the writers on the subject since his time have adopted as the fundamental *data* of their calculations, the hydrodynamic law of spouting fluids, by which the velocity of discharge is found to be proportional to the square root of the height of the superincumbent column of homogeneous fluid.

The author investigates particularly the methods of calculation proposed by Dr. Gregory, Mr. Davies Gilbert, Mr. Sylvester, Mr. Tredgold, and M. Montgolfier, and points out the differences which exist in their several methods. That of Mr. Sylvester is the only one which differs in any considerable degree from the simple law above stated; and his calculation is based upon the supposition that the respective columns of light and heavy air represent two unequal weights suspended by a cord, hanging over a pulley—by which mode of calculation, in the cases selected by the author for comparison, a result is obtained of only about one-third the amount given by the other methods. These calculations are compared with some experiments made by Sir John Guest at the Dowlais Iron Works, and also of Mr. Dufrenoy at the Clyde and at the Butterly Iron Works, recorded by him in his report to the Director-General of Mines in France. The results are tabulated; giving the pressure of the blast, the area of discharge, the velocity of the blast, the quantity of air ascertained by experiment, and the quantity shown by the several methods of calculation. From all these comparisons the author draws the conclusion that the method of calculation proposed by Montgolfier is the most accurate as it is also the most simple. If the pressure be ascertained in inches of mercury, it is only necessary to find the column of air in feet equivalent to the pressure, and to multiply this number (as in the common case of gravitating bodies) by 64 feet, and then the square root of this product will give the velocity of discharge in feet per second. The equivalent height of the column of air in feet is found by multiplying the number of inches of mercury by 11,230 and dividing the product by 12, mercury being 11,230 times the weight of air. Allowing for a small loss by friction in the quantity found by experiment, the agreement between the theoretical and experimental quantities is extremely near. Rules are likewise given for applying these calculations to other gases of different specific gravities, which are also applicable to chimney draughts and to the expansion of air by heat.

End of Session 1840.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

Tenth Meeting.—*September*, 1840.

(From the Athenæum.)

Section G.—Mechanical Science.

"*On certain Improvements on Locomotive and other Engine Boilers.*" By Mr. Hawthorn.

The object of this improvement is to prevent what is technically called "priming," to heat the steam on its passage to the cylinder, and to employ return tubes, as well as direct tubes, for heating the water. The advantages are said to be, that no water is carried with the steam into the cylinder, and a saving of fuel, through the arrangement of the tubes, from 30 to 40 per cent.

Mr. Scott Russell observed, that the plan of surcharging steam was much used in America. They work the steam expansively. Mr. Russell thought the *dome* shape in the fire-box inferior to the *flat stayed* box, and was afraid that the steam, returning from the cylinder through the boiler, would merely abstract and not communicate heat.

"*On the Fan-blast as applied to Furnaces.*" By Mr. Fairbairn.

In explaining the methods to be pursued in adapting furnaces to the fan-blast, Mr. Fairbairn observed that it was well known that its application to the cupola for melting pig iron was attended with the most complete success; and the object of the present inquiry was to determine how far the same mode of blowing was applicable to furnaces on a large scale, for the purpose of smelting ores. Objections had been made to Mr. Fairbairn's plan, on account of the very low pressure at which the air is introduced into the furnace, and its insufficiency to force it through a mass of material such as is contained in the furnaces of this country, and which is from 30 to 40 feet in depth. To these objections Mr. Fairbairn replied, that the same had been urged against the introduction of the fan-blast to the cupola; that, in his opinion, its efficiency was as the quantity discharged, and not the pressure, which regulated the passage of the air from the "twyres" to the top of the furnace. The fan-blast, when supplied with large apertures into the furnace, would, in his opinion, increase the process of calcination, effect a more equable temperature, and produce a superior quality of metal. It appeared, therefore, of importance that the experiment should be made, and Mr. Fairbairn offered to superintend its introduction, provided the proprietors of the numerous works in this country agreed with him in opinion, that the process would be advantageous both as regards expense, and the improved quality of the metal produced.

Mr. Smith thought the plan well worthy of being tried. It is not the *force* of the blast that is necessary, but the *quantity of air* introduced. In a cupola in which the blast is given by the fan, the iron is brought down in half the time that was necessary with the cylinder blast. Mr. Smith has no doubt of the success of the fan-blast in smelting furnaces, the heat being more uniform.

"*On Propelling Boats on Canals.*" By Mr. Smith.

Mr. Smith proposed that the steam power in the boat should drive two large wheels, of thirty feet diameter, which should bite the ground at the bottom of the canal. He exhibited a working model on this principle, which succeeded on the small scale; and he stated that he had tried it on a larger scale with the power of four men, and it had also succeeded. The wheels might be either on each side of the boat, as in the model, with a provision for a play of three or four feet, that they might accommodate themselves to inequalities at the bottom of the canal; or there might be one wheel in the centre of the boat, if constructed on the twin principle.

Mr. Scott Russell was not sanguine as to the success of this plan. The wheels must be made very heavy, in order to give the propelling power, and their weight would have an injurious effect at the bottom of the canal. A large steam boat would be necessary in order to get sufficient power, and if this large vessel were propelled at high velocities, the surge from the bows would be very great, and the stern would drag in the water.—Mr. Smith said, that he had confidence in the plan, notwithstanding the objections raised, and intended to try it on a large scale, and would report next year to the Association the results, whether favourable or otherwise.—Mr. Glynn remarked, that an attempt was made some years ago by Mr. Seaward, to propel boats on canals by means of wheels composed of two rims, with steps between them as a ladder, running on the bottom of the canal; but it was abandoned.

"*On a New Rain Gauge.*" By Mr. James Johnston, of Greenock.

Mr. Johnston described a new rain gauge, so constructed that the receiving funnel or orifice at which the rain enters, is always kept at right angles to the falling rain. By the action of the wind on a large vane, the whole gauge is turned round on a pivot, until the front of the gauge faces the quarter from whence the wind blows; and by the action of the wind on another vane attached to the receiving funnel, the mouth of the funnel is moved from a horizontal towards a perpendicular position according to the strength of the wind. The receiving funnel and vane attached to it are balanced with counterpoise weights, in such a manner that the wind, in moving them, has as much weight to remove from a perpendicular position, in proportion to their bulk, as it has when moving an ordinary sized drop of rain from the same position; by this means the mouth of the gauge is kept at right angles to the falling rain.

Mr. Milne gave an account of a High Pressure Filter for Domestic Purposes.—Mr. Thom stated, that from experience he found it was better to filter *downwards* than upwards.—Mr. Hawkins agreed with Mr. Thom, that filtration downwards is superior to filtration upwards; he preferred charcoal to sand for filtering, and preferred filtering without high pressure.

Mr. Dunn explained Ponton's Electro-Magnetic Telegraph, which instrument was exhibited in the model room.

Mr. Fairbairn described Hall's Patent Hadraulic Belt for Raising Water.

M. le Comte de Lille explained his method of laying down Wood Pavement, as exemplified at Whitehall.

The Rev. Dr. Paterson gave an account of an *Improved Life Boat*, which he called a Riddle Life Boat, because the bottom is like a riddle. The sides of the boat consist each of a hollow elliptical tube, to be made of sheet-iron, and from this it has all its buoyancy, which is unaffected by any influx of water. This boat, he said, was light, easily propelled, and drew only a foot or two of water; and besides being used for reaching vessels in distress, or carrying passengers to steam boats, it might be itself carried as a ship's boat —to be ready for use in danger, or difficult landing.

Mr. Williams stated, that this boat seemed to be original, and that he (Mr. Williams) would make a trial of it on a large scale.—Mr. Vignoles thought it might be usefully employed for pontoons.

"*On an Improved Rain Gauge.*" By Mr. Thom.

It consists of a cylinder two feet long, and seven inches diameter, sunk in

the earth till the mouth of its funnel (which receives the rain) is on a level with the ground surrounding it. Into this cylinder is put a float, with a scale or graduated rod attached to it, which will move up or down as the water rises or falls in the cylinder. There is a thin brass bar fixed within the funnel, about half an inch under its mouth, with an aperture in the middle just large enough to allow the scale so move easily through it. The upper side of this cross bar is brought to a fine edge, so as to cut but not obstruct the drops which may alight on it. There is an aperture also in the bottom of the funnel, through which the water must pass into the cylinder, and through which also the scale must move; but this aperture requires to be made no larger than just to permit the scale to move through it freely. When the gauge is firmly fixed, and the float and funnel in their places, water is to be poured in till the zero of the scale is level with the upper edge of the aperture.

Mr. Thom gave an account of the water filters used at Greenock and Paisley. A species of trap rock or amygdaloid, common in the neighbourhood, is broken to the size of small peas, and mixed with fine sharp sand. The water is filtered by passing directly downwards through the media, which media are in their turn cleansed by passing the water through them upwards. The filter does best at two feet of pressure and under.

"*Description of a Revolving Balance.*" By Mr. Lothian.

The opposing arms of this balance are curved, being formed of two spirals, the one situated vertically over the other, and both bending round a common centre of movement, which is placed in the pale of the upper curve. The spirals diverge from each other near their origin, but approach and merge together at their extremes, and thus form one continuous curve, which is grooved on its circumference. The cords or chains which suspend the receiving scale and counterpoise act against each other in this groove—the weight of the scale, when hanging from a lengthened radiant of the upper spiral, being in equilibrio with the greater weight of the counterpoise when hanging from a shorter radiant of the lower one. When this state of rest is disturbed by loading the scale, the balance moves round, and, in the progress of its revolution, the opposite eccentricities of the spirals combine in changing the ratio of the leverage, and thus originate a self-adjusting power, by which the loads of both cords are mutually moved into equilibrium. The receiving scale thus commences with greater, and ends with less mechanicel power than the counterpoise—a circumstance which is in harmony with the purpose of employing an unchanging weight to measure others both less and greater than itself; while the principle is one which concentrates the power and abridges the size of the machine. In order, however, that the total amount of adjusting power thus generally obtained may be equally drawn upon and advantageously distributed throughout the movement of the balance, a definite relation is established between the weight of the counterpoise and the rates at which the accumulating weight of the scale and the leverage of the lower spiral increase. The leverage of the upper spiral, being derived from these ascertained conditions, is made to preserve a rate of decrease which accords with the previously regulated increase in the leverage of the lower curve; while both spirals have their precise form determined by the additional consideration of the direction in which the cords exert their power on the circumference of the balance. In their calculated formation, the two spirals are thus dependent on and related to each other, while together they are component parts of one continuous curve, in which the mutual and combined changes of leverage are made to follow an equable, as well as a general progressive gradation; by which means, the balance is moved through equal angles by equal weights. In machines intended for weights of considerable amount, the balance is made to revolve about an axis, which is itself supported, a little above its centre, on knife-edge rests, so as to combine the movement of the revolving balance with the libration of the common one—the coincidence of a pointer from the axis with the ordinary pointer of the machine showing when the indication is practically unaffected by friction. In machines for weights of still greater magnitude, the articles to be weighed are made to act, in part, as their own counterpoise, by adopting differential curves to diminish the descending power of the scale; by which a comparatively small counterpoise is made to adjust the unsupported difference of weights greatly exceeding itself.

"*On the Combustion of Coal and the prevention of the generation of Smoke in Furnaces.*" By Mr. Williams.

Mr. Williams observed, that in treating on steam and the steam-engine, the subject divides itself into the following heads:—1st, The management of *fuel* in the generation of *heat;* 2nd, The management of *heat* in the generation of *steam;* 3rd, The management of *steam* in the generation of *fuel.* The first belongs to the *furnace;* the second to the *boiler;* and the third to the *engine.* The first, although exclusively in the department of chemistry, is to be considered in the Mechanical Section, for the purpose of chowing its connexion with the practical combustion of fuel in the furnace. The main constituents of coal are carbon and bitumen: the former is convertible, in the *solid* state, to the purpose of generating heat; the latter, in the *gaseous* state alone, and to this latter is referable all that assumes the character of *flame.* The greater part of the practicable economy in the use of coal being connected with the combustion of the gases, this division of the subject is peculiarly important. We all know that combustible bodies cannot burn without air: the actual part, however, which air has to act is little inquired into beyond the laboratory; yet on this part depends the whole of effective combustion. Having explained the nature of combustion, Mr. Williams went on to show, that all depended on bringing the combustible and the air into contact in the proper quantities, of the proper quality, and at the proper time—the proper place, and the proper temperature. The conditions requiring attention were, 1st, The quantity; 2nd, The quality of the air admitted; 3rd, The effecting their incorporation or diffusion; 4th, The time required for the diffusion, and, 5th, The place in the furnace where this should take place. Mr. Williams euhibited several diagrams, representing the several processes connected with the combustion of a single atom of coal-gas or carburetted hydrogen, and also of bodies or masses of such gas. The essential difference between the ordinary combustion of this gas in combination with atmospheric air, and that resorted to by Mr. Gurney in combination with pure oxygen, in what is called the Bude light, was then explained. By these diagrams, it was shown, 1st, What was the precise quantity of air which the combustion of gas demanded; 2nd, The degree or kind of mixture which combustion required; and, 3rd, That the unavoidable want of time in the furnace to effect this degree of diffusion was the main impediment to perfect combustion, and the cause of the generation of smoke. From the consideration of these details, the inference followed, that smoke once generated in the furnace cannot be burned,—that, in fact, smoke thus once generated became a new fuel, demanding all the conditions of other fuels. Mr. Williams dwelt much on the chemical error of supposing that smoke or gas can be consumed by bringing it into contact or connexion with a mass of incandescent fuel on the bars of a furnace; that, in fact, this imaginary point of incandescence, or the contact with any combustible body at the temperature of incandescence, was peculiarly to be avoided, instead of being, as hitherto, sought for; and hence the failure of all those efforts to prevent or consume smoke. The great evil, then, of the present furnaces was their construction, which did not admit the necessary extent of time (or its equivalent), time being essential to effect the perfect diffusion of mixture of the gas, of which every chemist knew the importance, and on which the experiments of Prof. Graham were so conclusive. Mr. Williams then proceeded to show, that unless some compensating power or means be obtained, and practically and economically applied, we can never arrive at full combustion, or prevent the formation of smoke. This compensating power was shown to be obtainable by means of surface, and was well exemplified in the blow-pipe: the remedy then, for the want of time in the furnaces, may be met, by introducing the air in the most effective situation, by meaus of numerous small jets. Mr. Williams submitted the primary law to be this; viz., that no larger portions of air, that is, no greater number of atoms of air, should be introduced into any one locality, than can be absorbed and chemically combined with the atoms of the gas with which they respectively come into contact. Again, that the effecting, by means of this extended surface, this necessary diffusion was the main condition which required attention, and not that of temperature. Mr. Williams then exhibited the diagram of a boiler to be constructed on the above principles, and stated that he had an experimental boiler at work, which fully proved the accuracy of the principle.

Sir John Robison stated, that the Committee of Recommendations had suggested the appointment of a Committee to make a further investigation, and report to the Association at their next meeting.—Mr. Vignoles observed, that the gradual increase of the aperture for the blast of cupolas for second meltings of metal, the areas of which were now at least fifty times larger than formerly, proved the necessity of admitting large quantities of oxygen in combustion, which could only be obtained in its combination with the nitrogen, the other component part of atmospheric air.

"*On the Temperature of the Earth in the deep Mines in the neighbourhood of Manchester.*" By Mr. Eaton Hodgkinson.

Mr. Hodgkinson having, some years ago, received from Prof. Phillips four thermometers belonging to the Association, got, through the kindness of the proprietors of the following pits, and other parties connected with them, experiments made upon the temperature of the earth in each of them:—The salt-rock pit, 112 yards deep, belonging to the Marston Salt Company, near Northwich, Cheshire; the Haydock Colliery, 201 yards deep, near to Warrington; the Broad Oak Coal-mine, 329 yards deep, near to Oldham. In the latter pit, a thermometer placed in a hole three feet deep, bored in "metal," and closed at the aperture, was examined weekly by Mr. Swain for twelve months, the temperature varying from 57° to 58½° Fahr.—it being lowest from the beginning of February to the middle of May, and highest in September and October to the middle of November. The experiments above mentioned were made in 1837 and 1838, and the results mentioned at the Birmingham meeting; but the Broad Oak pit having been increased in depth since that time, a thermometer was inserted in it, in a hole bored in metal, as before. It was in a place 408 yards deep, and indicated a temperature of 61°, remaining nearly constant for twelve months. Mr. Fitzgerald being recently engaged in sinking a deep coal-pit at Pendleton, two miles from Manchester, Mr. Hodgkinson conceived this to be a favourable opportunity for getting additional information on the subject of subterranean temperature, and, on his application to the proprietor, the engineer (Mr. Ray) readily made for him, during the sinking of the pit, and afterwards in the workings, the experiments of which the results are below. At 418 yards from the surface, the temperature, in a hole from three to four feet deep, bored in dry rock, was 66°; at 450 yards deep it was 67°; and at 480 yards it was 69°. In the workings at 461 and 471 yards deep, it was in both cases 65°. The mean temperature of the air at Manchester, according to Dr. Dalton's experiments, is 48° Fahr.; and, as the pits above mentioned are not very far from Manchester, the mean temperature of the earth at the surface of each of

them may be considered as 48°. With that supposition, the distance sunk for each degree of Fahrenheit would be as below:—

In the rock pit	32 yards.	
Haydock coal pit	20 „	
Broad Oak pit	33·7, 31·4	32·5 „ =mean.
Pendleton pit (shaft)	23·2, 23·7, 22·8	23·2 „ =mean.
Ditto (in workings)	27·1, 27·7	27·4 „ =mean.

The mean from the whole being 27 yards for each degree of temperature.

The President remarked, that Mr. Hodgkinson's results gave the rate of increase of temperature greater near the surface, and then decreasing, which did not agree with the results of other observers: this, he conceived, arose from nearly the same cause as that already remarked upon when Mr. Fox's report was under consideration. Mr. Hodgkinson commenced to reckon his descents or depths, not from the surface, but from the plane of invariable temperature, which in these latitudes was not far from 60 feet.—Prof. Forbes illustrated simply by a diagram how this caused the rate of increase at first to be too high, and then to diminish. He then alluded to the frozen soil of Siberia, gave a description of it, and said, that it had been sunk through to a depth of 382 feet without being penetrated—that is, without reaching a temperature of 32°, although the temperature of the surface was not below 18°. In this case, the rate of increase was rapid.

"*On the Temperature and Conducting Power of different Strata.*" Prof. Forbes's Report.

In this report, he wished to give the results of the observations made at Edinburgh during the year 1839, upon thermometers sunk at depths of 3, 6, 12, and 24 French feet into trap rock, pure loose sand, and sandstone. The details for the years 1837 and 1838 were already laid before the British Association at Birmingham. In order to render the report of the results for 1839 intelligible, Prof. Forbes went over nearly the same explanatory matter as that which is already published in the report referred to. He then exhibited the curves derived from the three years' observations, remarked upon their wonderful agreement, and gave, in a tabular form, the results for the three years, which were as follows:

Values of A (A being the constant in the formula given in the report referred to).

	In trap.	In sand.	In sandstone.
For 1837	1·164	1·176	1·076
1838	1·173	1·217	1·114
1839	1·086	1·182	1·049

Values of B (the other constant).

	In trap.	In sand.	In sandstone.
For 1837	·0545	·0440	·0316
1838	·0641	·0517	·0345
1839	·0516	·0498	·0305

Variation reduced to 0·01° Centigrade.

	In trap.	In sand.	In sandstone.
For 1837	58.1 feet	72·2 feet	27·3 feet.
1838	49·3	61·8	91
1839	59·2	63·5	100

Velocity of propagation for one foot of depth.

	In trap.	In sand.	In sandstone.
For 1837	7·5 days	7·1 days	4·9
1838	6·8	6·8	3·6
1839	7·8	7·2	4·6

"*Observations on the Tides in the Harbour of Glasgow, and the velocity of the Tidal Wave, in the estuary of the river Clyde, between Glasgow and Port Glasgow.*" By William Bald.

Mr. Bald stated that he had been for a considerable time past engaged in making observations on the rise and fall of the tides in the harbour of Glasgow. The first series of observations was commenced on the 26th of April 1839, and extended to the 1st of October 1839, and contain 158 observations of the rise and fall of the tides. The first portion of these observations were only made during the day, and did not extend to the night tides. These 158 observations assigned the mean rise and fall of tide in the harbour of Glasgow, to be 6 ft. 7 in. 20d.* The number of tide observations made from the 1st of October 1839 to the 27th August, amounts to more than 1,200. These also had been tabulated and divided into months, but such of the tides as have been much disturbed by floods Mr. Bald had rejected. By reference to the table exhibited for October 1839, the first line stated from the 1st of October to the 7th of October, number of tides 13; mean rise and fall of these 13 tides was stated to be 6 feet 5 inches; the mean low water of these 13 tides below top of South Quay wall in the harbour of Glasgow, was 15 ft 8½ in., the mean high water below top of South Quay wall, 9 ft. 3½ in.; and the mean half-tide level below top of South Quay wall, 12 ft. 6 in. The table showed the number of tides for new moon, first quarter, full moon, and last quarter; the total number of tides for each month, the mean rise and fall of tide per month, the mean low water below top of South Quay wall, mean high water below top of South Quay wall, and mean half-tide level below top of South Quay wall per month. The mean rise and fall of these 1213 tides assigns an average of 6 ft. 8 in. 98d.; and the first series of 158 tides assign a mean rise and fall of 6 ft. 7 in. 20d. It also appeared from other tables and observations, that the tidal wave runs from Port Glasgow to Bowling, at a rate or velocity of 14·56 miles per hour; from Bowling Bay to Clyde Bank, at a rate of only 6·82 miles per hour; but from Clyde Bank to Glasgow Harbour at a rate of 10·85 miles per hour. The diminished velocity between Bowling Bay and Clyde Bank arises from the channel of the river being more crooked in that part than any other portion, thereby showing the great necessity of straightening and improving it.

* Smeaton, in his report on the River Clyde, dated the 3rd September 1755, states the neap tides as only being sensible at Glasgow Bridge.

ROYAL INSTITUTE OF BRITISH ARCHITECTS.

Monday, Dec. 7.

The first meeting of the Session was held this evening, the President Earl De Grey, in the chair. His Lordship in taking a short view of the arrangements proposed for the opening session, congratulated the members upon the prospects before them, and upon the increasing prosperity of the Association.

A paper was read upon some of the characteristics of the "Gothique flamboyant," from the pen of Professor Willis, honorary member. The peculiarity to which the Professor chiefly referred, was the complicated manner in which the mouldings and members are made to cross and interpenetrate in the French Gothic. The system is not unknown in the English perpendicular style, but with us it is confined to such cases as arise simply from the juxtaposition of the component parts of the architecture, whereas in the Gothique flamboyant, new members are unsparingly laid one over another with the express object of producing the most intricate combinations. Some curious examples were exhibited from the Cathedral of Nevers, and other continental buildings.

Dec. 21.—Charles Barry, Esq., in the Chair.

M. Duban, of Paris, and Signor Raffaele Politi, of Girgenti, were elected honorary and corresponding members.—The former of these gentlemen is the architect of the New Ecole des Beaux Arts, at Paris, and is greatly distinguished by his knowledge of the French national architecture of the sixteenth century.—Signor Politi is the author of a work on the Antiquities of Agrigentum, and is well known and highly respected by all English artists who have visited the shores of Sicily in the prosecution of their studies.

A paper was read on Gothic Vaulting, by Mr. Ferrey, Fellow, exemplified by a description of St. Katharine's Chapel, at Abbotsbury, in Dorsetshire, a building of the reign of Edward IV., very peculiar both in its design and construction, and especially remarkable for its great solidity, which seems to have been dictated by the elevated situation of the building, and its exposure to violent sea storms. The roof, which is a wagon headed vault is of solid masonry, every part affording a like degree of strength, contrary to the ordinary mode of Gothic vaulting, where the ribs alone yield support, the panels being rebated or borne on the back of them. Upon this vaulting is laid a body of rubble, shaped to the angle of the external roof, and upon the rubble the outer covering, consisting of regular masonry, each stone having a level bed, and being therefore secured in a manner totally different from stone tiling. The details of this roof, and of several other Gothic vaults with which Mr. Ferrey compared or contrasted it, taking occasion to introduce many general remarks, were exhibited in numerous drawings, and an attempt to follow the subject, independently of these illustrations, would be an injustice to an excellent practical paper.

ARCHITECTURAL SOCIETY.

Ordinary Meeting: 17*th Nov.*, 1840.—Michael Meredith, Esq., in the Chair.

The Chairman expressed his regret at being obliged to inform the meeting that Mr. Phillips, who was to have read a paper this evening, had very unexpectedly been called from London, and was, in consequence, unable to fulfil his engagement with the Society, and having apologized for Mr. Philip's absence, stated that he had, by special request, brought up, for the inspection of the meeting, drawings to the same scale, from actual measurement, of three churches built by Sir Christopher Wren, viz., St. Bennett Finck, Threadneedle Street; St. Bartholomew, Bartholomew Lane, Bank; and St. James's, Garlick Hill, Doctor's Commons. Also two sketches, being designs for the new painted window, Bishopsgate Church.

Mr. Meredith made some observations on the system of competition, which were well worthy of consideration, and in so doing introduced to the attention of the meeting the designs for the new painted window in Bishopsgate Church, and he finished this portion of his subject by some interesting remarks on the design and effect of painted windows in general.

Mr. Meredith also made some observations on the great talent exhibited by Sir Christopher Wren in the designs of the churches introduced this evening, and offered a summary comparison between the churches erected by Sir Christopher Wren in general, and those erected by other architects in and about London.

Monthly Meeting: 1st. Dec., 1840.—William Tite, Esq. President, in the Chair.

Mr. A. W. Hakewill read a most interesting paper, being extracts from the life of Mons. Percier, which he enlarged upon with some very ably penned remarks of his own, founded on observations made while in pursuit of his studies in Rome and Italy, and having reference to the classic taste displayed in the buildings of that country, and also to the fitness of the design for the purposes intended.

MEETINGS OF SOCIETIES IN JANUARY,

At Eight o'clock in the Evening.

Institution of Civil Engineers, Tuesday	12	19
Royal Institute of British Architects, Monday	11	25
Architectural Society, Tuesday	12	26

TEMPLE CHURCH.

(From the Times.)

Within the present century a marked, and it may be called a classical taste has in general been shown whenever repairs or additions have been required to the ancient architectural remains, the legacies of our Anglo-Saxon ancestors, whether ecclesiastical or civil. The real or affected distaste for what was contemptuously called Gothic architecture, which may be dated from the time of the second Charles, continued to increase till the accession of George III. The passion for the antique in the reign of the former would appear even to have blinded Sir Christopher Wren to the absurdity of attempting to improve the wild and mysterious architecture of Saracen or Celtic origin, by uniting it to the classic regularity of the Greek or Roman school. The failure of the attempt appears in the towers of Westminster Abbey, and in the altar screens of many of the cathedrals erected from his designs. It is but in the present century that the genius of Wyattville restored the royal seat of Windsor to that character of castellated and palacial magnificence which the fopperies of Charles had obscured. How many sacred edifices might be pointed out, the "dim religious light" of whose venerable walls seem as if they breathed devotion, and which, in the most careless, are calculated to call the mind from the thoughts of the fleeting present to the eternal future, were they not desecrated by the "beautifications" which on all sides they are informed have taken place, during the presidency, may be, of the worshipful churchwardens Ebenezer Smith, or Timothy White, the testimonials of whose patriotic parochial monstrosities are handed down to posterity emblazoned in golden letters on gigantic tablets, and the fruits of whose exertions appear in the loads of whitewash and paint which has destroyed the severity and altered the character of the ancient structure. The time-worn banner of the founder in many may still be seen drooping over the poetical encomiums passed on the machinations of these utilitarian worthies, as if it "lamented the weakness of these later times."

These heresies of taste are, however, giving way before a better understanding of the beautiful, as is exemplified in the repairs which have lately taken place in the cathedrals of Norwich, Rochester, and Peterborough, the Abbey of St. Alban's, and the borough church of St. Saviour's, from which last the western part of the edifice must, however, be excepted.

That affectation of puritanical simplicity in the fitting up of our churches, which to many of them has given rather the appearance of a hall devoted to the meetings of a civic council than a temple of divine worship, is also fast disappearing; a better taste has arisen, which is shown in devoting the labours of art and the efforts of genius in decorating the edifice itself, making it worthy the purpose for which it is designed, rather than in extolling the parentage of living monied humanity, or applying it to the luxurious accommodation of those who feel more disposed to hear the Gospel of truth when they find, in the house of their creator, the luxurious accommodations of their own.

The church called the Temple, although considerable sums were, some few years since, expended on it, has, on inspection, been found in such a state of decay, that its actual existence, for any lengthened period of time, was more than doubtful; in consequence of this, the Societies of the Inner and Middle Temple have generously determined that it shall be restored to its pristine state and beauty; they have justly considered themselves as guardians of one of the most ancient and beautiful ecclesiastical monuments of our country, and one of the very few which the fatal fire of 1666 spared in the metropolis. In the repairs of this church, it has been determined entirely to adhere to the ancient model, to do away with all the meretricious additions and miscalled embellishments with which its walls have been encumbered, to clear the interior of the wooden pens which have been planted in it, and to offer it to the antiquarian and the public, when completed, as the most perfect metropolitan specimen of the olden time.

The repairs of this church, when finished, will make it so perfect a specimen of ecclesiastical architectural beauty and chaste magnificence, as can hardly be rivalled in the kingdom. Many of the cathedrals may, in portions of their elevations, and in the ornamental garniture, if it may so be called, of their interiors, be as perfect; but as they have, with few exceptions, been erected in different ages, their architecture does not symmetrically harmonize together. There are few of them in which the Saxon, the Norman, the Saracen, the Gothic, or the Greek or Roman style is not blended in different portions of the edifice, and, the eye becoming confused by diversity, the effect which a symmetrical whole has on the imagination is lost. It may even be a matter of doubt whether the introduction of modern monumental sculptures, however great may be their merit as works of art, when not in alliance with the character of the locations in which they are placed, does not materially deduct from the effects of both.

The repairs and alterations which are taking place in this church consist in removing all the pews which occupied and encumbered the centre of the building; they will be replaced by a series of stalls carved in oak coeval with the character of the edifice, which will be placed north and south in the manner of those in a cathedral, sufficient space is left between them and the walls to allow a passage; in the centre will be convenient moveable benches. By this means the magnificent grouped columns will be visible from their bases to their capitals; the modern screen erected in the time of Charles II., which separated the western from the eastern portion of the edifice, is removed, as is also the organ, which was placed upon and completed the partition; it will be fixed on a building which has been erected on the western side of the structure, which communicates with the interior of the church by two of the lateral windows. By this arrangement a great advantage is gained, the whole extent of the church, with its lofty columns, intersecting arches, and vaulted roof, strikes the eye on entering the Roman portico of the western entrance. It was incontestibly proved, in removing the barbarous whitewash from the vaultings, that they had originally been painted in the most splendid tints; there was not enough left to show the particular design, but it has been determined that they should be restored, which has been done with the elegance and richness which characterired ornaments of the class. The vividness of the colours and the delicacy displayed on this mosaic fresco, relieved by the dark sculptured divisions of the vault, has rarely been surpassed. On removing the floor to examine the bases of the columns, it was found that its original level was considerably below its late one; it is to be so replaced that they will have their just proportions; the pavement will be formed, not partly of wood and marble as before, but painted tiles and tesselated pavement, in the manner of those of the sanctuary of Winchester. The three windows at the eastern end of the church and others at the south side, will be filled with stained or painted glass in the ancient manner, composed of small pieces, the figures and ornaments of which will harmonize with the age of the edifice; they are in the hands of Mr. Willement, who designed the ceiling; he has preserved in them that minuteness of execution, that delicacy of detail, and that brilliancy of colour united with chasteness of design, which so well assimilates with the architecture of a Gothic edifice. The arms of the Society will be emblazoned in it, those of the Inner Temple, which consist of a horse striking the earth with his hoof, or "a Pegasus luna on a field argent."

The monuments, excepting those of the recumbent knights in the round church, have been removed, and it is proposed to erect a cloister adjoining, and communicating with the edifice, to receive them. This will be a great improvement; the beautiful simplicity which the building in its leading lines presents, a heterogeneous series of monuments, tablets, and inscriptions must necssarily destroy; the space between the windows is too small, and never was intended for them; besides which, it will allow of these parts having a decoration of ornamental painting, similar to that of the ceiling, this being necessary to give due and complete effect to the latter. Immediately under the windows is a marble cornice, which, when restored, will seem to belt round the building and justly lead the eye, by its unbroken line, to give full value to its extent. All the smaller columns which are attached to the internal ones that support the roof, and those on the side walls which receive the ribs of the arches, are found, the smaller to be Purbeck marble, and the larger of Caen stone; whitewash, neglect, and age had effectually concealed their beauty; the splendid polish of the former, which rivals a mirror in brightness, will be restored, and their hue of ebony will stand in effective contrast with the cream-coloured hue of the latter. The caps of those in the round church are beautifully carved, according to the fashion of the age in which they were constructed. The outline of all is uniform, and the detail of each is varied; by this a simplicity and singleness of effect

is produced in the whole, and the minutest examination presents a never-ending variety, by which the first impression is extended and maintained. The whole of these architectural restorations are being executed under the direction of Mr. Savage, of Essex Street. When completed, this ancient edifice will become an additional ornament to the metropolis—a perfect and unrivalled specimen of the olden time. But the restoration of this beautiful church is not the only good which the liberality of the Societies of the Temple will have effected; they have been the means of proving what may and can be done by the artists and artizans of England, when taste directs and liberality remunerates. Such an example, set in such an edifice, will, in all probability, have a powerful effect in the progress of church decoration in all its departments.

LAND SURVEYING—THE SCALING INSTRUMENT.

Sir—Though having had something to do with the improvement of the new scaling instrument, now used in the Tithe Commission Office, yet I do not feel called on *seriously* to contradict the assertions of "Surveyor," which appeared in your last month's publication. Nor would I presume to obtrude the following observations on your pages, if the remarks that called them forth had not a tendency to contravene the great principle upon which your very useful work is professedly based. It appeared that your valuable publication was to be made the great reservoir wherein to deposit the beneficent contributions that freely emanate from the generous and communicative head of genius, and from which source, those valuable contributions may be made liberally to circulate for the noble and philanthropic purpose of giving increased facility to the *practical efforts* of such persons as may not be so largely endowed with the inventive faculty.

Some few however there are to be found so exceedingly contumacious—so irresistably wedded to old prejudices—and so very vain of their fancied perfections in their several professions, that, like the barbarian Chinese, they reject with affected scorn every proposed improvement, the adoption of which would involve them in the painful and humiliating admission, that there existed such a *monster* as a *superior!*

With "Surveyor," continuous labour is professedly preferable to ease and dispatch. If labour be the consequence of a "curse," every inventive ability given and exercised, to remove or lessen that physical incubus, evinces a disposition somewhere to lighten the anathema: but if the stand still or retrograde movement stupidly advocated by "Surveyor," be acted on, we must be content (though human necessities daily increase) painfully to endure the miserable infliction: we must be satisfied to spend months at the drudgery of trigonometrical, or astronomical, or other calculations *in the old way*, rather than avail ourselves of the "ready reckoner" or the log books prepared by a Napier or a Newton—lest the month's labour should be diminished to *so many* days—and that we might not *dishonourably* substitute the easy effort of the boy, for the overstrained and painful exertions of the man!!

But we tell "Surveyor" that there is not the slightest chance that his intimation will have any effect. And likewise, that the advocates of all petty interests and monopolies, however they may frown and storm in their pigmy habiliments, must bow the neck to the overwhelming force of successful improvement and reform.

From the self-confident tone of "Surveyor," one would be led to suppose that he would willingly submit to a fair trial between his old method and the application of the instrument; if it were only for the purpose of convincing other persons who have given it a trial, that he was sincere in his rejection of it; and that he had no sinister motive for giving public expression to the act of "laying it on the shelf."

I now confidently assert that the same quantity of average work may be done twice with the instrument, for once that it can be done by "Surveyor's" method, and with a much greater degree of accuracy, and defy him to the practical disproof upon any fair conditions he may propose.

One can scarcely suppress the full ebulition of his risible faculties on reading the latter part of his letter, at his puerile attempt to touch the high reputation of a notable and eminent engineer, by his ("Surveyor's") *generous* offer of a lesson at the chain. From such a sample we may expect that the next unsolicited proposal of this astonishing preceptor will be, to instruct some of the first literary characters of the day in the letters of the alphabet. On this point, however, it is apparent that the very limited extent of his own acquirements has rendered him incapable of recognizing or appreciating the full extent and variety of, individual acquisition.

With these few remarks I beg to conclude, hoping that if "Surveyor" should again have any desire for entering your columns, that he will do so with a single eye to the main object of your Journal, and not under the mere influence of selfish or vindictive passions.

I have the honour to remain, Sir,
Your very obedient servant,
B. T. C. O.

December 24, 1840.

REVIEWS.

(*Continued from page* 16.)

A Practical Inquiry into the Laws of Excavation and Embankment upon Railways, &c. By a Resident Assistant Engineer. London: Saunders and Otley, 1840.

(Second Notice.)

The remaining part of this work which we have announced our intention of noticing, is devoted to the investigation of the barrowing system, in which the author proposes to give the result of his inquiry into the subordinate system of removing earth by means of wheel barrows and human labour. We regret that even the small share of praise we felt justified in bestowing on the first part of the treatise cannot be extended to the part now before us.

And in order that our readers may the better judge in what degree the author is warranted in the strong contrast which he draws between his own labours in this field of inquiry, and those of former writers, we shall present them with an extract from his works, rather out of its true position, namely, the concluding paragraph, in which he glances with some contempt at the efforts of his predecessors, and turns with infinite complacency to the superiority, in all respects, of the process which he has himself employed.

> It will also be seen, that the principles upon which former authors attempted to develope the general laws of excavation and embankment, were evidently adopted, without any reference to the practical working of the system; and, that the mode of making their observations, (whenever they were made), was much too isolated, for the purpose of affording an expanded and comprehensive view of the various agencies—collateral and direct—which are continually acting, one upon the other, and by which the ultimate results are collectively influenced. The error into which they have fallen, seems to have consisted in assuming, as their constants, quantities in the abstract; or in observing in detail, instead of the aggregate; and adopting the results of these separate observations, as if entirely independent one of the other: and therefore it is not to be wondered at, that many matters, essential to the thorough sifting of the subject, were altogether excluded; and that the arguments founded upon these self-begotten phenomena, led them to a belief, in the inverse ratio to probability, if not of possibility itself. Thus, the antecedents being widely unconnected, and, from their number, subject to frequent error; the consequents derived from their combination, turned out utterly fallacious. The method we have pursued is exactly the reverse: our constants depend upon observations, made upon the combined effects, produced by the various agencies in the aggregate; and, by an analysis of these we have descended, step by step, to the details; and not advanced, from the minutiæ of detail to abstract generalities, which have no foundation in truth.

We shall reserve till the end of our review the observations we have to make upon the boasting presumption of the latter sentence, remarking merely, in the mean time, that a more complete delusion never entered into the mind of man than that which seems to have taken possession of our author, when he imagines that he has made any thing like an analysis of the subject of which he is treating. His process has been on the contrary purely synthetical, and we fear that rarely have such weighty and important conclusions been based upon such a miserably scanty foundation.

The experimental part of this investigation commences with three experiments, from which our author derives the following fact: "*that the mean time spent in filling a barrow, wheeling it four runs of twenty-five yards each, and returning with the empty barrow, is* 5′ 45″. He then gives two experiments which determine 7′ 20″ *for the time spent in filling one barrow, wheeling it four runs of twenty-five yards each, and returning with the empty barrow,* including *also the time spent in filling the same barrow a second time, and wheeling it forward two runs.* Hence taking the difference of these two times, the author makes $7'20''-5'45''=1'35''$, the times which elapsed in filling one barrow and wheeling it forward two runs, or which is the same thing, $1'35''=$ the time of filling a barrow, wheeling it one run, and returning with the empty barrow.

It is next assumed that the time of filling the barrow must be equal to the time of wheeling over one stage, and returning with the empty barrow. Hence $\frac{1'35''}{2} = 67''$ (47'') the time of filling each barrow. The whole time occupied in making the experiments from which this result has been derived is somewhat less than 32 minutes, this being the sum of the observed times in the whole five experiments.

We need scarcely pause to notice how completely inadequate must be a limited experience of this kind as a standard for estimating either the expense or rate of progress in removing earth by barrows. As well might a traveller estimate his rate of progress from the beginning to the end of the journey, by observing his speed during some particular half hour. As well might a vessel's rate of sailing for weeks, months, or for a whole year be infallibly prognosticated from the information afforded by a simple page of the log book.

We challenge all the examples since the beginning of time, where grand conclusions have been drawn from insufficient premises, to bear comparison with the instance which our author has here furnished. Telford, Rennie, Mylne, Smeaton, and all the other great engineers under whose guiding genius not a few great earth works have been executed long ere railways were thought or heard of, how many a laborious inquiry, and how many a painful lesson would have been saved to you, had the experience been yours, of the half hour during which these important experiments were made.

It is due to our readers, however, to inform them that there are three more experiments, "conducted," say the author, "in a different manner." The difference consists in this, that these experiments are made upon a number of barrows together, instead of single barrows, as in the first set of experiments.

We relate this second series of experiments in the author's own words, and we make no comment upon them, as our readers will perceive at once that they are equally insignificant in point of extent with the first five which we have noticed at length.

Experiment 1.—Twenty-four barrows were filled, wheeled forward two runs, and tipped, in thirty-eight minutes and forty-eight seconds; which is the same in effect, as if they were filled, wheeled *forwards and backwards*, and tipped upon *one* run, during the same time.

Experiment 2.—Eighteen barrows were filled, wheeled forward one run, and brought back empty again, in twenty-five minutes, and forty-two seconds.

Experiment 3.—Eleven barrows were filled, wheeled forward upon two runs, and emptied, in eighteen minutes; which is the same in effect, as if they were filled, wheeled forward, emptied, and brought back, upon one run.

From these experiments it is determined that 1'·37'' is "the mean time which elapsed while a single barrow can be filled, wheeled one run, emptied, and brought back;" we are then told that 37 barrow loads can be wheeled on each road per hour. And our author, assuming, we suppose, the weight of all earths to be the same, derives from this fact the performance of each single barrow road, and upon any number of these working together. It is obvious that this assumption is most erroneous, as for example, the specific gravities of different soils may be stated thus, common mould 1·46, sand 1·52, sandy loam 1.6, clay or marl 1·712, gravelly sand 1·784, gravelly clay 1·93, common land gravel 2·017, rough water gravel 2·32, common sand stone 2·5, lime stone 2·7.

Thus, supposing that a man can wheel of common mould 37 cube yards in a day of 10 hours, which accords with the author's statement of his performance, he would only be able, with the same labour, to wheel 23 cube yards of rough water gravel. And, without multiplying examples to show the fallacy of any assumed standard, such as the author derives from his experiments, it may be observed, in general terms, that the quantity which can be wheeled will be inversely proportionate to the specific gravity of the stuff, and not by any means constant for all soils.

Another error into which the author has fallen, is that of taking 25 yards as the invariable length of a run. Our own opinion is, that this is too great a length for a level road; but, besides this, it is most important to notice that, in order fairly to apportion the labour of wheeling, the length of each man's run must vary according to its rate of inclination. In practice this is always attended to, the workmen usually being quite expert at fixing the position of the stages or resting-places, according to the slope of the run.

There is yet a third error which we cannot pass over, namely that of supposing two men always to be employed in filling, during the time of the wheeler's absence, so that one loaded barrow may always be ready for him each time he returns to the filling place. It is evident, and experience, moreover, has shown, that in some soils, such as light sands, a single filler will keep the wheeler constantly going, whereas in others, such as stiff clays and marls, three and even four men are necessary for the same purpose.

Of such consequence, in an inquiry of this kind, are the particulars which, as we have seen, the author has omitted to consider, and so fallacious are the general assumptions in which he has indulged, that we cannot refrain from expressing our decided disapprobation of this second part of the work.

We have only further to remark, that with all these faults in his own work, it is scarcely to be borne that such a lofty contempt should be evinced by the author for all that has ever been written before on this subject. Certain we are, and we are happy to say it for the honour of the profession, that there are not wanting many, many practical men, who, if they have never *written* on the subject, contain in their own heads, or perhaps in the shape of private memoranda, such a complete acquaintance with the system of barrow work, that they can predict accurately, on examination of the locality, every circumstance of expense, time of execution, number of men and quantity of materials required, in any particular work.

This, we presume, would indicate at least as much knowledge of the subject, in all its bearings, as the author of this inquiry could possibly imagine any person capable of acquiring from the perusal of his work. But how different in value must that knowledge be which is obtained by the practical experience of years, from that which is based upon the experiments of a few hours' duration. The information of the practical man consists of gross results, with all the attendant circumstances of which he is, or ought to be, acquainted; and his method of arriving, where necessary, at the separate details, is really analytical, and so directly opposed to the process of establishing gross results from separate experiments in detail.

LITERARY NOTICES.

A very able work "on the Law and Practice of Letters Patent for Inventions," by Thomas Webster, Esq., has just been published, we shall notice this work in the next month's Journal.

Mr. Whishaw's long expected work on the Railways of Great Britain and Ireland has at length appeared. We received it so late in the month that it precludes our examining it with the attention which it deserves, we must therefore postpone our remarks, excepting so far as saying, that it contains several engravings of Locomotive Engines, all the rails in use, and other details connected with railways, very beautifully executed; with valuable tables showing the results of practical experiments as to the actual working of English Railways.

The History of the London and Birmingham Railway, by Lieut. Lecount, is a republication of his interesting and valuable contributions to Roscoe's illustrated work on that subject.

The Building-ground Calculator, by E. W. Garbett, Architect, contains a series of Tables for ascertaining the value of Land per acre, when divided out into plots of various depths from 100 to 300 feet, at prices from 5½*d.* to 14*s.* 5½*d.* per foot frontage, or £10 to £105 per statute acre.

NEW INVENTIONS AND IMPROVEMENTS.

Improvements in the construction of steam boilers and engines, and of locomotive carriages; patented by Frank Hills, of Depford, manufacturing chemist, November 5, 1840.—These improvements are numerous and difficult to explain without the illustrative engravings; a tolerable idea of their nature, however, will be conveyed by the following list of the ten claims;—1. The employment of a series of vertical tubes partly filled with water, and having small pipes passing down their centres, forming passages for smoke or heated air. 2. The employment of a series of vertical tubes which are closed and unconnected at the top, and open at the lower end, which communicates with a chamber, or series of chambers, partly filled with water; and which tubes have small pipes passing up their centres, for the purpose of conveying the steam to the boiler with which they are connected. 3. The use of flat chambers connected by means of pipes, filled with water, the upper portion of such chambers, forming steam chambers. 4. The employment of wooden felloes to wheels used for locomotive and other carriages, which felloes are enclosed between two vertical wrought iron rings, to which the spokes of the wheel are welded. 5. The employment of hollow arms, which are open at the ends on which the wheels revolve, and through which opening the driving shaft passes. 6. The employment of collars or enlarged pieces running in bearings, which have a groove and are connected with the brass containing oil, in order that a regular supply may be afforded to the working parts requiring the same. 7. The method of filling up the space between the arms of the (Hero's) engine. 8. The method of reversing the motion of the engine by employing two sets of arms, with other apparatus hereafter described. 9. The mode of inserting a wooden block or other slow conductor of heat between the tube which communicates the motion and the driving shaft. 10. The mode of imparting motion to an engine shaft, by means of an arm or crank being

fixed on the middle of such shaft, and driven by one of two connecting rods alternately, which are both driven by the piston rod and guided by radius rods.—*Mechanics Magazine.*

Improvements in wheels and locomotive engines to be used on railways; patented by David Gooch, of Paddington, Engineer, Nov. 20, 1840.

These improvements consist simply in forming the outer or working surface of the tire of engine and carriage wheels, of steel, which may be made of any required degree of hardness. The application of steeled tires to wheels used on railways, (it is said) has hitherto been prevented by the difficulty of forging and fixing them. The following method of surmounting this difficulty is Mr. Gooch's:—A faggot of wrought iron bars are worked and hammered, or rol ed into a solid piece, and afterwards drawn out in rolling, or under the hammer upon an anvil, having a groove to form the flanch, into the state of rim iron. An indentation or hollow is then made, lengthwise of the bar near the flanch, in order to prepare it for the reception of the steel. A faggot of steel bars is then so arranged, that when hammered and worked into its proper (wedge) form, the edges of the bars shall form the broad surface of the tire. The two bars of iron and steel thus prepared are then welded together, and afterwards formed into a rim or hoop of the form required. The wheel being prepared in the usual way, and its rim turned, it is laid flat on a true face-plate, and the tire being regularly and uniformly heated red hot, is put round it. The whole is then plunged into cold water or other frigorific mixture, which contracts the tire and hardens the steel. Holes having been previously drilled through the steel hoop, are now continued through the rim of the wheel, and both are rivetted together. Or, the rivets may be advantageously dispensed with when the steel is driven well into the indentation prepared for its reception. "Many important advantages," says this patentee, "will arise from the use of steeled tires on railways; besides the economy immediately resulting from the greater durability, a vast reduction will be effected in the wear and tear of the engines, the carriages and the rails; while a corresponding improvement will arise in the comfort and safety of travellers. The intense friction to which the wheel is subjected, occasions a rapid wear and tear of the iron tire, productive of most injurious consequences. An indentation is soon formed by the rails on the tire, which disturbs the action of the wheel, and destroys smoothness of motion. The same causes derange the action of the engine itself; every revolution of the locomotive wheel brings an irregular strain on all the parts, which materially increases the wear and tear to which they are liable. Great damage is also done to the railway, on which the wheels at every revolution act like so many ponderous hammers. It has been found advantageous to make the working surface of the wheels conical, diminishing from the flanch; but the conical surface of the iron tire is soon worn down, and the wheel made conical the reverse way, causing a serious loss of tractive power and increase of friction on all the parts affected. By the use of steeled tires these evils are henceforth to be avoided, the extreme hardness of the surface enabling them to endure without injury the action of the rails for a considerable length of time."—The claim is, 1. The mode described of forming and hardening steeled tires of wheels to be used on railways. 2. The use of steel in the tires of engine and carriage wheels for railways.—*Mechanics' Magazine.*

An improvement or improvements in the mode of resisting shocks to railway carriages and trains, and also in the mode of connecting and disconnecting railway carriages; also in the application of springs to carriages; patented by William Henry Smith, late of the York-road, Lambeth, but now of 20, Rockingham-row, West, New Kent-road, Engineer, dated Nov. 28, 1840.—The first improvement consists in applying to railway carriages certain combinations of machinery or apparatus, affording an increased length of elastic resisting power, with a consolidated action of the same, calculated to obviate the present liability to danger. The second, a peculiar mode of connecting the engines or carriages, whereby they may be more readily attached to each other, or instantly detached, thus placing them more completely under the control of the engine-man or conductor, by whom the connection may be broken (without his leaving the foot-plate) in case of the engine getting off the rails or meeting with any other accident; or a solid connection may thus be formed between the carriages, causing a simultaneous action of the whole train upon one point of resistance, thereby lessening the amount of spring or other elastic resistance required, and at the same time ensuring greater safety and efficiency of action. The third, consists in a certain application of the vertical or side springs, by which is obtained in a greater degree an universal action of the carriage, presenting an increased elastic resistance in the direction of the shock, whether lateral or vertical. In the first case, a series of helical or other springs are placed in parallel rows, side by side, beneath one of the carriages; a single buffer-bar extends, by connection, through the whole length of the train, and projects about five feet beyond the carriages at each extremity. This buffer-bar is connected to two cross arms, which abut against the two ends of the series of springs already mentioned. A buffer at the end of the bar receiving any shock, it is transmitted along the bar to the cross pieces impinging on the springs, which present an elastic resistance to such pressure. As these springs can be acted upon from either end, should a collision occur from one train overtaking another, both would, if thus equipped, be found unhurt, the consolidated resistance in each being brought simultaneously into action. Another mode of resisting sudden shocks is by means of a male screw upon the buffer-bar running along the under side of the carriage frame, having a quick thread "so as to fall by its own gravity," and turn freely in a nut or collar firmly affixed to the carriage. Any shock, it is said, would be transmitted through this collar in a much less degree (proportioned to the angle of its thread). The end of the screw is attached to a strong verge spring, which increases the resistance to the turning of the screw as it is wound up, so as completely to overcome the shock. The screw is acted upon by a buffing-bar. "The main value of this part of my invention," observes the patentee, "is, that the spring is affected but in a small degree by the amount of shock endured; its principal portion being received in the collar, and the resistance not increasing in the same proportion against the spring as in the ordinary methods; but by the screw's application, I calculate, five-sixths of the effect of the concussion would be received by the collar (*ergo: by the* CARRIAGE), and the same proportions to any extent." A third method of resisting shocks is by means of an hydraulic apparatus, consisting of a large close cylinder filled with water, placed under the carriage; a piston works loosely in this cylinder, the piston rod passing through a stuffing box, and forming the buffing bar; a passage under the cylinder, which connects its two ends, is closed by a cock. On encountering a shock, the buffer-bar forces the piston along in the cylinder, the water rushing from before it through the open cock, the contracted orifice of which impedes its progress and checks the motion of the piston. As the piston rod is pushed in, a connecting rod passing from it to the cock closes the latter, when the water can only escape by the sides of the piston, thus offering a still greater amount of resistance. The piston is capable of working either way, according to the end of the train from which the shock is received; and owing to the piston not fitting tightly, there will be no liability of it or the cylinder receiving any injury. There is a reacting spring for restoring the piston to its original position.—The mode of connecting and disconnecting railway carriages is by the following arrangement:—A connecting bar is attached to the engine by a pin joint, and kept in the right position by a staple pendant from the foot-plate; at the other end of this bar there is a piece projecting upwards. A bell-mouthed aperture is let into the front frame of the tender or carriage, which guides the before-mentioned bar into the recess in case of any variation of the relative positions of the carriages. On pushing the carriage, &c. up to the engine, the bar enters the aperture, pressing down a strong spring until the projecting piece of the bar enters a slot or cavity prepared to receive it, when the spring rises and forms a permanent connection. In order to disconnect the engine, it is only necessary to press with the foot upon a small rod, which, acting on the projection, forces down the spring, and allow the bar to be withdrawn.—The new mode of applying springs to carriages of every description, consists in adapting four sets of helical springs, to work obliquely between the wheel axles and carriage frame, being inclined at the angle of about 40° from each other towards the ends of the carriage. The object of this arrangement is (said to be) to receive the jerk in whatever way it may come, either from the wheels or the buffers, and transfer it to the opposite spring, which together (the one by compression, the other by expansion) present an additional resistance to the action of the shock. These springs have also a double vertical action resisting shocks either from above or below.—*Ibid.*

Improvements in railway and other propulsion; patented by John George Shuttleworth, of Fernly-place, Glossop-road, Sheffield, gentleman, Nov. 28, 1840.—The contrivance of this gentleman bears a very close resemblance, in many parts, to the atmospheric railways long before the public, except that in the present instance the patentee proposes to employ a denser fluid (water) as the motive power. A horizontal main or tube is laid along the line between the rails, having a slot or opening on its upper surface; this aperture is smallest at the top, and expands downward. A piston fits the interior of this tube, and terminates in a peculiarly formed guide-neck, for taking up and applying to the aperture in the pipes a continuous flexible valve or stuffing of india rubber or other suitable material. In front of the guide-neck there is one vertical and one horizontal wheel, to guide the piston steadily along the line with the smallest possible quantity of friction; while a thin metal plate passes up through the opening, and is attached to a railway carriage of the ordinary construction. At the commencement of the line, a vertical pipe conveys a column of water on to the horizontal main, through a valve or cock opened or shut at pleasure. The efficiency of this agent may be produced by the pressure of an elevated reservoir, or by the application of steam power to force it into the pipes. On turning the cock the water rushes into the main, and drives the piston, with the carriage to which it is attached, forward; the flexible valve, which lies along the bottom of the main, but passes through the guide-neok and up over the piston, is raised as the piston travels along, and forced into the opening of the pipes, where it is kept by the pressure of water behind the piston.—The claim is—1st. The application of the power of a column or body of water acting against a piston in a tube, to which piston a railway carriage, or other object to be propelled, is fastened for the purpose of propulsion. 2nd. The improved guide-neck to the said piston for raising and conveying to its proper place the flexible valve or stuffing required to fill the slot or space left open in the upper part of the propelling tube for the passing of the plate.—*Ibid.*

Improvements in the manufacture of certain descriptions of cement; patented by Richard Freen Martin, of Derby, gentleman, Dec. 2, 1840.

The improvements which form the subject of this patent, relate more particularly to those descriptions of cement for which a former patent was obtained, dated Oct. 8, 1834, but are also applicable to other cements, as set forth hereafter. In the former patent, in order to produce certain hard cements, it was directed that gypsum, either in its natural state or as plaster of Paris, or limestone, or chalk, or lime, in the state of powder, should be mixed with a solution of any strong alkali neutralized by an acid, (American pearlash and sulphuric acid being preferred) and that water should be added to the mixture till it was in a fit state for casting or moulding into cakes, and to be subsequently dried and burned. The patentee has since discovered that the said processes may be facilitated and the cost of them reduced in the following manner;—

First, instead of employing alkaline and acid solutions, the acids and alkalies are to be used in the solid state, either added separately or previously combined together, and no more water employed than the materials themselves contain.

Secondly, in certain cases the addition of the alkali, or both the acid and the alkali are dispensed with, and the quantities of these ingredients incorporated in the substances themselves are depended upon, to form the bases of the cements. In carrying out the first improvement, a quantity of pearl-ash is dissolved in water, to which is added a sufficient quantity of sulphuric acid to form a neutral compound; this mixture being evaporated to dryness, leaves the required compound in a solid state.

When it is desired to add the acid and alkali separately in a solid state to the gypsum, chalk, &c., pearl-ash is used and dissolved, or where cements of

superior density are required, some of the alkaline earths (barytes for instance) are employed. The acid constituent is obtained by using sulphur or sulphuric acid in combination with other matters, as pyrites and mineral sulphates, or some solid substance containing both an acid and an alkali, as alum, &c. In this case it is necessary so to regulate the acid and alkaline proportions, that they shall always exactly neutralize each other. The acid and alkaline matter being provided in any of these ways, is to be mixed with gypsum, or lime-stone, or chalk, in the following proportion: to any given quantity of either of the foregoing or similar substances, add as much solid alkali and acid as that for every part by weight of alkali (of the strength of the best American pearlash) there shall be about 150 parts of the gypsum, &c., or of the gypsum and lime combined in equal proportions. These materials are then to be ground together into a fine and well-mixed powder, which is to be first dried and afterwards calcined in suitable revolving cylinders. By the second improvement, cement may be formed by combining gypsum and lime with a third substance containing or producing an acid; or by combining gypsum and lime alone, without the addition of any third substance either of an acid or alkaline quality. 1. About two parts by weight of gypsum are to be mixed with one part of lime, and for every 100 parts of lime or thereabouts, there is to be added one part of sulphur, or of some substance from which acid is produced, regulating its quantity according to its superior or inferior acid-producing qualities. 2. To make a cement from gypsum and lime alone, these are to be mixed in such proportions as that the moisture given off in the process of calcining them together by the gypsum, shall be just sufficient to slake the lime. When the London grey-stone lime is used, about two parts of gypsum are required to one part of lime. In all cases the materials are to be ground and calcined as before stated. The mode of using the cements thus formed is the same as set forth in the specification of the former patent. It is found to be advantageous to use none of such cements in a fresh state.—*Ibid.*

Important to Mariners.—We have lately read so much of the calamity of shipwreck, that any attempt to lessen its horrors, must be hailed as a real blessing. Few that have not heard of Captain Manby's Life-Preserver. We have just witnessed a successful attempt of simplifying the principle upon which that valuable discovery is founded, so as to be available wherever a common cannon and a piece of rope are at hand. There is no occasion for a mortar or a rocket, a common ship gun will answer the purpose. The experiment was lately tried on the sea shore, about a mile southward of Aberistwith. We had been previously informed that Mr. Page, the superintendant of the Harbour Works, had, at the instance of the Harbour Trustees, directed his attention to the subject, and we are glad to state with the most perfect success. The machinery is the simplest possible. A common twelve pounder that belonged to the old *Agenoria,* was placed on the store, elevated to 40 degrees, and leaded with a nine ounce charge of powder, with a well fitted wadding. Before us lay a long coil of rope, ¾ inch diameter, with a stout piece of wood or plug, of the length of a common spade fastened to it. This plug is intended to be put in the mouth of the gun. The ploblem to be solved, was to project this piece of wood over the breakers before us, so that should a vessel have struck there, as we remember one to have done about 18 months since at that very spot, and the sea should be too high for any boat to live in the surge, a rope might be sent from the land to the ship, or from the ship to the land. The simplicity of the whole affair struck us extremely, and no alchymist waited with more anxiety the moment of "projection" than we did the firing of the cannon. Those that know anything of these matters will understand us when we say that our great apprehension was, lest the rope should *snap*—that being the great difficulty to be got over in these experiments. But our apprehensions were quite needless. The gun was fired once, twice, thrice, and the plug and rope were hurled beyond the breakers without a thread of the latter breaking or straining. Its length was 160 yards; but it might be extended by increasing the charge of powder. That peculiarity of the apparatus upon which the engineer mainly depends for counteracting the tendency of the rope to break is, by strengthening about two feet of that part of it which comes in contact with the plug; this is done by adding to it four others of the size of lead lines, and which are bound together with pieces of spun yarn, and fastened to the plug with four small staples, the main rope or a bit of chain instead, being fastened to it, by a ring and thimble. Thus strengthened, the rope is found sufficiently strong to stand unharmed against the jerk with which it is projected from the cannon, and this it could not do without the four extra supporters. Upon enquiring of the engineer why he preferred a wood plug to a rocket or ball, he stated that in case of a man overboard, the plug would *float*; and that also in case of being fired *from* a vessel, it would from its buoyancy be carried on shore by the mere action of the sea. Its extreme simplicity is its great recommendation. There are few vessels without a cannon of some size on board, and a hand-spike or capstan bar will answer the purpose of a plug perfectly well. We should have stated that the wetness of the rope after the first discharge was found to be of no inconvenience, but care should be had in coiling it properly, so as to enable it to play out with facility.—*Carmarthen Journal.*

New Code of Signals on the Great Western Railway.—The whole of the engine-drivers, stokers, guards, conductors, and other persons employed on the railway throughout the line were assembled at the engine-house of the Paddington station last week, when a new code of signals, prepared by Mr. Brunel, the engineer-in-chief to the company, were fully explained to them by that gentleman, and several of the signals were put into practical operation. A special train was sent from the Paddington to the Farringdon-road station, to convey the engineers, stokers, guards, &c., at that end of the line to town. By the adoption of the new code, distinct and immediate intimation will be given to the engine-drivers and others of the least obstruction along the line.

Eastern Counties Night Signals.—The manager of this company, R. Hall, Esq., has invented an ingenious system of night signals for the Eastern Counties Railway. On the back part of the chimney of the engine is placed a reflector, so inclined that a light pressing from the top of the train will be reflected down upon him. The two guards sent with every train are provided, besides their common lights, with two signals consisting of blue and red lights. Upon the removal of a piece of tin, a screw presses upon some fulminating powder, which immediately ignites the signal, and gives out a most intense light for some time, which, falling on the engine reflector, is sent down concentrated upon the engine man, so that he is immediately aware of the signal. The blue light indicates caution, and the red light danger. The light is so exceedingly intense as to give a brilliant illumination all around, and the men who have tried it declare if they were asleep it would wake them. The present signals throw off several luminous balls in succession, but Mr. Hall will in future use the light only. At the junction of the Northern and Eastern, and other parts of the line, the men are provided with these signals. A sliding reflector is added to give greater power to the light, but from what we have seen, we are of opinion that that is unnecessary, as the lights are so strong that they may, in our opinion, be seen for 10 or 15 miles off.—*Railway Magazine.*

LAW PROCEEDINGS.

PATENT LAW—AMENDMENT OF SPECIFICATION.

IN THE MATTER OF JOHN SHARP'S LETTERS PATENT.

In the Rolls' Court, Tuesday, Dec. 22.

Lord Langdale pronounced his decision upon the petition of Joshua Wordsworth (reported in last month's Journal, page 428,) for expunging from the memorandum of alterations in the specification of Sharp's letters patent "for machinery for converting rope into tow," certain portions which were alleged to be in substance descriptive of the same machinery as was invented by the petitioner. The petition stated that Sharp had, under the 5th and 6th Will. IV., c. 73, with the leave of the Solicitor-General, entered with the Clerk of the Patents certain memorandums of alteration of part of his specification, which alterations the petitioner, Wordsworth, complained of as a new arrangement of machinery, extending Sharp's patent to what the petitioner alleged was in substance his own invention for heckling and dressing flax, &c., as described in his specification. His Lordship said he had delayed his decision for the purpose of collecting information as to what had been done by the Court respecting amendments of specifications, and it appeared it was usual to make amendments in the enrolment in cases where there were clerical errors *negligenter per incuriam vel ex lapsu calami scriptoris,* and this had been done, sometimes by reference to the Master of the Rolls, by the Lord Chancellor, and in one instance by the Lord Chancellor himself upon an order from the Crown, sometimes by writ of Privy Seal, sometimes by consent of the Attorney-General, and sometimes by sign manual. In all modern instances the alterations had been merely clerical. It did not appear that the Master of the Rolls as keeper of the records had ever exercised any authority in matters of this kind when the error complained of was not merely clerical. He was clearly of opinion that he had no authority to make the alteration asked for, and he must dismiss the petition with costs.

The Queen v. the Grand Junction Railway Company.—MANDAMUS.—*Court of Queen's Bench, November* 15.—Sir F. Pollock applied for a rule, calling on the Grand Junction Railway Company to show cause why a writ of mandamus should not issue, commanding them to obey the enactments of the 19th section of the Act 3 Victoria, cap. 49, which was as follows:—"And be it further enacted, that the charges of the said recited Acts, or either of them authorised to be made for the carriage of any passengers, goods, animals, or other matters or things to be conveyed by the said company, or for the use of any steam power or carriage to be supplied by the said company, shall be at all times charged equally and after the same rate per mile or per ton per mile, in respect of all passengers and of all goods, animals, on carriages of a like description conveyed or propelled by a like carriage or engine passing on the same portion of the line only, and under the same circumstances, and no reduction or advance in any charge for conveyance by the said company, or for the use of any locomotive power to be supplied by them, shall be made, either directly or indirectly, in favour of or against any particular company or person travelling upon or using the same portion of the said railway, under the same circumstances as aforesaid." He made this application at the instance

of Messrs. Pickford, the carriers, who would, unless the court interfered to protect them from the company, be obliged either to give up the carriage business altogether, or to carry it on without deriving any profit from it. It appeared from the affidavits, that the usual method of transmitting goods from London to Liverpool and Manchester, was by the London and Birmingham Railway to Birmingham, thence by the Grand Junction Railway to Newton, and from Newton by the Liverpool and Manchester Railway to those towns respectively. The Grand Junction Company had, it appeared, granted to Messrs. Chaplin and Horne the accommodation of permitting the trucks on which their goods were placed to pass at once from the London and Birmingham line to the Grand Junction line at Birmingham, and from the Grand Junction line at Newton to the Liverpool and Manchester line, without any change of carriage or unloading, but since September last had refused to afford similar facilities to any other carriers; and when applied to by Messrs. Pickford on the subject, had informed them that they could not afford them the desired accommodation unless they paid something additional for it, while it was afforded to Chaplin and Horne gratuitously. The expense of loading and unloading the trucks would be about £5. a day additional to Messrs. Pickford, besides the loss of time which it would occasion them. It appeared also that the company at the Camden Town station charged 65s. a ton for the carriage of goods to Liverpool or Manchester, but they made Messrs. Chaplin and Horne an allowance of 10s. a ton for collecting and distributing the goods in London, which allowance they refused to make to Messrs. Pickford. There was a clause in every railway act empowering other persons than the company to start locomotives and trains on the railroad, but this was a complete dead letter, inasmuch as the company might refuse such persons the use of their pumps or of their coal depots, and had also unlimited power in regulating the times of starting, &c., of such engines. The fact was, the company was aiming at a complete monopoly of the carrying trade, which they would certainly acquire unless they were compelled to obey the enactments of the clause in question.—Mr. Justice Patteson granted a rule to show cause.

PROGRESS OF RAILWAYS.

Manchester and Leeds Railway.—Completion of the Summit Tunnel.—On the 9th ult. the last brick of this great undertaking was keyed-in by Barnard Dickinson, Esq., the resident engineer, who was presented on the occasion (by J. Stephenson, Esq., the contractor) with a silver trowel, the gift of the inspectors and sub-contractors on the works. The tunnel was lighted by torches, and a large company of ladies and gentlemen were present to witness the ceremony. At twelve o'clock, Mr. Stephenson, accompanied by his manager, Mr. G. Mould, Mr. Dickinson, and other gentlemen connected with the company, entered the tunnel amidst the acclamations of the party assembled, when Mr. Stephenson, in presenting the trowel, congratulated Mr. Dickinson on the successful completion of a work, which, but for the united skill and enterprise displayed in its execution, would have been insurmountable. Mr. Dickinson then finished this great work, by keying-in the last brick, amidst the cheers of the spectators; after which he delivered an animated address, in the course of which he observed that some idea might be formed of the amount of labour employed in the construction of the tunnel, when he informed them, that had it been left to the unassisted efforts of one man, it would have taken him as much time to complete it as had elapsed between the commencement of the Christian era and the present day, namely, one thousand eight hundred and forty years! At the conclusion of the ceremony the company were invited to partake of a cold collation at the Summit Inn, when several excellent speeches, having reference to the completion of the work, were delivered in the course of the evening. The workmen were also regaled with abundance of good cheer within the tunnel.—*Midland Counties Herald.*

Oldham Branch Railway.—On Saturday, the 12th ult., a number of the directors of the Manchester and Leeds Railway, accompanied by their principal engineers, visited Oldham, and examined the country between Oldham and the main line, for the pupose of determining the best course for the Oldham Branch Railway.

Contemplated Railway through Blackburn.—We rejoice in being enabled to state that the first step has at length been taken to secure to Blackburn and the surrounding district the advantages of a railway communication with the North Union and Manchester and Leeds lines. On Thursday last, a highly respectable meeting was convened by circular, at the Hotel, in King-street, to confer with Mr. Stephenson, the eminent engineer, and two other gentlemen of the same profession who accompanied him, upon the subject. The meeting was well attended, and but one feeling appeared to pervade the company, viz., an anxious desire for the accomplishment of the object in view. The engineers exhibited a map of the different railways, with the proposed line from the North Union at Preston, through Blackburn, Accrington, and Burnley, to the Manchester and Leeds line at Todmorden, a distance of about twenty-six miles.—William Turner, Esq., M.P., having been called to the chair, a long conversation took place between Mr. Stephenson, the chairman, William Feilden, Esq., M.P., Joseph Feilden, Esq., P. E. Towneley, Esq., James Neville, Esq., and others, the result of which was the appointment of a committee, to confer with the directors of the North Union and Manchester and Leeds Companies, and also with the owners of property on the proposed line; and to ascertain what pecuniary assistance they were disposed to render towards obtaining a survey, from Preston to Burnley, the cost of which was estimated at £700. The ground from Todmorden to Burnley, we believe, has already been surveyed; and it is understood that the Manchester and Leeds Company are disposed to extend their line to Burnley, provided another company be formed to continue it through Blackburn to Preston. Should this expectation be realised, and there appears no reason to doubt that it will, it will do much to facilitate the proposed undertaking.—*Blackburn Standard.*

PUBLIC BUILDINGS, AND IMPROVEMENTS.

Fresco in the New Houses of Parliament.—Cornelius, the celebrated German painter, is, it is said, on his way to this country, where he is to be consulted as to the frescos of the new Houses of Parliament. Certainly Cornelius has no merits which can give him a superiority over Englishmen in the representation of English scenes. We have no illiberal prejudices against foreign artists, and should be the first to recommend the purchase of their works for our public collections, but we think that when any great national commemoration is the subject, the employment of foreign artists is a desecration of the monument. It is thus also we view the employment of Marochetti at Glasgow. How differently would Titian, Murillo, Rubens, Rembrandt or Lebrun represent the English people in the performance of the same action—however great might be the skill of the artist, he would be wanting nationality. How are we ever to become a great nation in art, when we are deprived of the only opportunity of giving scope to the powers of our artists!

Wesleyan Chapel, Great Queen Street.—The small portico which has been attached to the front is completed.

British Museum.—A temporary communication has been opened through the Long Gallery, so that the visitor is now able to proceed all round the Museum. In the upper Egyptian room are two fine specimens of Egyptian sculpture in *intaglio rilevato*, highly deserving of attention.

Clifford.—On Monday the 23rd of November, the foundation stone of a new church about to be erected at Clifford, in the parish of Bramtram, in the West Riding of the county of York, was laid by Miss F. E. Fox, daughter of George Lane Fox, Esq., of Bramham Park. The ceremony was attended by many of the clergy and gentry in the neighbourhood. This church will be endowed with £1,500 by G. L. Fox, Esq., and the Dean and Chapter of Christ Church, Oxford, give £200 further endowment when the church is opened. It will be built by subscription in the neighbourhood and elsewhere, which has been liberally responded to. The design is furnished by Messrs. Atkinson, architects of York, to whose charge the building is intrusted. The church is intended to contain 300 persons in free pews, and there are no galleries. It is built in the form of a cross, with transepts; and a tower 70 feet high at the west end, and is of the pointed or early English style. The entire building is faced with free stone from the neighbourhood, and the cost when complete will be about £1050.

MISCELLANEA.

Cornish Steam Engines.—The number of pumping engines reported this month is 54. They have consumed 3193 tons of coal, and lifted 30 million tons of water 10 fathoms high. The average duty of the whole is, therefore, 53 million pounds lifted one foot high by the consumption of a bushel of coal. Richards's stamps at Wheal Vor works with hot condensing water. The boilers are being changed at Trelawney's engine, Wheal Vor, and are leaky at Tincroft; Wheal Prosper; Cargise; Taylor's, Woolf's, and Bawden's engines, Consols; and at Hocking's engine, United Mine.—*Lean's Engine Reporter, December* 11.

The Lake of Haarlem.—The King of Holland has just authorized the raising of an additional loan of three millions of florins for draining the Lake of Haarlem.

Proposed Suspension Bridge over the Haslar Lake at Portsmouth.—The usual calculation for the maximum load on each superficial foot of the platforms of suspension bridges is 70 lb.; but, as in the event of a crowd of persons assembling, the pressure may increase to nearly 100 lb. per foot, and by the passage of soldiers marching in regular time the strain may be greatly augmented, the projector assumed 200 lb. per superficial foot as the amount of load to which the platform might be subjected. The peculiar feature of this bridge is the substitution of cast iron chains for the wrought iron ones generally used. This deviation from the usual practice is adopted as a measure of economy, and with a view of increasing their stability and durability, cast iron being much less influenced by atmospheric action than wrought iron. Cast iron beams, when well proportioned, will bear a very considerable tensile strain. As these chains would be proved beyond the weight they are intended to bear, no doubt is entertained by the author of their security. The platform, which is formed of transverse iron girders, carrying cast iron plates three quarters of an inch thick, with dovetails falling into holes cast in the girders, is suspended by wrought iron rods 1½ inch square from two lines of chain only, as the strain is more easily brought to bear on them than on a greater number of chains. They are trussed laterally to prevent oscillation, and the balustrade is so constructed as to prevent the undulation so prejudicial to suspension bridges generally. To insure a perfect bearing, each pair of links of the chains are, in manufacturing, cramped together, and the holes bored out to receive the pins, which are turned to fit them accurately; they are of a larger size than usual, being four inches diameter, and a less number are employed. The piers on which the chains pass are of cast iron, 33 feet high above the level of the roadway.

The extreme length of the bridge is	632 feet.
The breadth of the roadway	17½ —
The clear waterway between the piers	300 —
The clear headway of the platform above the high water line........................	18½ —
Ditto ditto above low water line........................	33 —

The tension on the chains is calculated as equal to 991·4143 tons. To sustain this tension, the section of the chains is 256 square inches, and taking seven tons per square inch as the elastic limit of cast iron, the resistance of the chains will equal 1,792 tons, leaving a surplus of 800·6 tons after the calculated strain has been deducted from the real strength of the chains.—*Inventor's Advocate.*

STEAM NAVIGATION.

Messrs. Rennie are fitting their trapezoidal paddle-wheel to the *African*, a government steamer, instead of the common paddle-wheel, which has been heretofore used; this will form an excellent criterion of the comparative advantages of the two wheels. They are also fitting similar wheels to a vessel for the French government.

The Screw government have determined upon building a steamer for the purpose of trying the Archimedean screw; orders have been given to Messrs. Seaward for a pair of engines of 200 horse power each, for working the vessel.

A Gravesend steamer is on the stocks, which is stated will run from the Blackwall Railway to Gravesend within the hour. Messrs. Miller & Ravenhill have the construction of the engines in hand.

Rotary Engines.—Mr. Galloway is about applying a rotary engine of his invention to a new boat, for the purpose of working the screw without the necessity of using any intermediate wheels or gearing. The boiler is tubular, upon the locomotive principle. Messrs. Rennie are constructing the engines, which are now being put on board at their wharf at Blackfriars.—Another boat is being fitted with Binns' patent rotary engines, of considerable power, and a tubular boiler, to work a wheel upon a new principle in the stern; the paddle-boards are suspended upon their axes, and allowed to work freely upon them without any stops, so that the paddle-board is always kept in a perpendicular position.

Launch of an Iron Steamer.—There was launched from Mr. Borrie's ship-building yard, Broughty Ferry, on Friday, 11th ult., an iron-built twin steamer, named the Princess Royal. This vessel has been built for the Tay Ferry Trustees, and is intended to ply between Dundee and Newport; her length on deck is 106 feet, by 34 feet in breadth, giving the extraordinary area on deck of 3604 square feet; she has been brought up to Dundee, and Mr. Borrie has commenced erecting her engines on board, which are of 80 horse power, and one in each of the hulls. The hulls are connected by the deck beams, and by six systems of transverse stays; the fastenings of these stays are placed within a few inches of the lead water line, for the more effectually maintaining the hulls in their true relative position; there is an intermediate space between the hulls, 10¾ feet in breadth, which extends the whole length of the vessel; there is only one paddle-wheel, and it works in this space nearly at the centre of the vessel, and is completely hid from view. When used as a ferry boat a twin steamer possesses many advantages, from her peculiar construction, over a single vessel; among these the most prominent are the great facility with which a twin steamer can take the quays from the absence of the paddle-wheels on the sides, great stability, easy motion in a cross-swell, great buoyancy, without having a great length and breadth of floors, and the sectional area of displacement not greater than what would obtain in a single vessel of the usual proportions. The form and finishing of this vessel are much admired, and will not fail to bring additional reputation to the contractor, whose eminence as an engineer is already fully acknowledged.

LIST OF NEW PATENTS.

GRANTED IN ENGLAND FROM 27TH NOVEMBER TO 23RD DECEMBER, 1840.

MILES BERRY, of Chancery-lane, Patent Agent, for "*certain improvements in looms for weaving.*"—Sealed November 27; six months for enrolment.

JOHN CLAY, of Cottingham, York, Gentlemen, and FREDERICK ROSENBORG, of Sculcoates, in the same county, Gentleman, for "*improvements in arranging and setting up types for printing.*" November 27; six months.

JOHN CONDIE, Manager of the Blair Iron Works, Ayr, Scotland, for "*improvements in applying springs to locomotive railway and other carriages.*"—November 27; six months.

GEORGE HOLSWORTHY PALMER, of Surrey-square, Civil Engineer, and CHARLES PERKINS, of Mark-lane, Merchant, for "*improved constructions of pistons and valves for retaining and discharging liquids, gases, and steam.*"—November 28; six months.

GEORGE BLAXLAND, of Greenwich, Engineer, for "*an improved mode of propelling ships and vessels at sea and in navigable waters.*"—November 28; six months.

HENRY BRIDGE COWELL, of Lower-street, Saint Mary, Islington, Ironmonger, for "*improvements in taps to be used for or in the manner of stop-cocks, for the purpose of drawing off and stopping the flow of fluids.*"—December 2; six months.

JAMES ROBINSON, of the Old Jewry, Manufacturer of Machinery, for "*a sugar-cane mill of a new construction, and certain improvements applicable to sugar-cane mills generally, and certain improvements in apparatus for making sugar.*"—December 2; six months.

ALEXANDER HORATIO SIMPSON, of New Palace-yard, Westminster, Gentleman, for "*an improved machine or apparatus for working pumps.*"—Communicated from a foreigner residing abroad. December 9; six months.

WILLIAM PEIRCE, of George-street, Adelphi, Gentleman, for "*improvements in the preparation of wool, both in the raw and manufactured state, by means of which the quality will be considerably improved.*"—December 9; six months.

CHARLES WINTERTON BAYLIS, of Birmingham, Accounting-house Clerk, for "*an improved metallic pen, to be called the Patent Flexion Pen and Improved Penholder.*"—December 16; six months.

GEORGE WILDES, of the city of London, Merchant, for "*improvements in the manufacture of white lead.*"—Communicated by a foreigner residing abroad. December 16; six months.

JAMES DAVIS, of Shoreditch, Engineer, for "*an improved mode of applying heat to certain steam-boilers.*"—December 16; six months.

JOHN STEWARD, of Wolverhampton, Esq., for "*an improvement in the construction of piano-fortes, harpsichords, and other similar stringed musical instruments.*"—December 16; six months.

JAMES MOLYNEUX, of Preston, for "*an improved mode of dressing flax and tow.*"—December 16; six months.

CHARLES BOTTON, of Farringdon-street, Gas Engineer, for "*a certain improvement in gas meters.*—December 16; six months.

HUGH GRAHAM, of Bridport-place, Hoxton, Artisan, for "*a new mode of preparing designs and dyeing the materials to be used in the weaving and manufacture of Kidderminster carpets, and for producing patterns thereon, in a manner not before used or applied in the process of weaving and manufacturing such carpets.*"—December 16; six months.

JOSEPH BEATHI, of Portland-place, Wandsworth-road, Lambeth, Engineer, for "*certain improvements in locomotive engines, and in carriages, chairs, and wheels, for use upon railways, and certain machinery for use in the construction of parts of such inventions*"—December 16; six months.

ANDREW PRUSS D'OLSZOWSKI, of Ashley-crescent, Gentleman, for "*a new and improved level for ascertaining the horizon, and the several degrees of inclination.*" Communicated by a foreigner residing abroad.—December 16; six months.

WILLIAM TUDOR MABLEY, of Wellington-street North, Mechanical Draftsman, for "*certain improvements in producing surfaces to be used for printing, embossing, or impressing.*"—December 17; six months.

ABRAHAM ALEXANDER LINDO, of Finsbury-circus, Gentleman, for "*improvements to be applied to railways and carriages thereon, to prevent accidents, and to lessen the injurious effects of accidents to passengers, goods, and railway trains.*"—December 18; six months.

ELIAS ROBINSON HANDCOCK, of Birmingham, Esq., for "*certain improvements in mechanism applicable to turn-tables, for changing the position of carriages upon railroads, for furniture and other purposes.*"—December 18; six months.

RICHARD COLES of Southampton, Slate Merchant, for "*improvements in machinery for manufacturing tanks and other vessels of slate, stone, marble, and other materials, and in fitting and fastening such materials together.*"—December 23; six months.

BENJAMIN BAILLIE, of Henry-street, Middlesex, for "*improvements in locks, and the fixings and fastenings thereto belonging.*"—December 23; six months.

JOHN BRUMWELL GREGSON, of Newcastle-upon-Tyne, Northumberland, Soda-water Manufacturer, for "*improvements in pigments, and in the preparation of the sulphates of iron and magnesia.* December 23; six months.

FREDERICK PAYNE MACKELEAN, of Birmingham, and JAMES MURDOCH, of Hackney-road, Civil Engineers, for "*certain improvements of or belonging to tables, a portion of which is applicable to other articles of furniture.*" Partly communicated by a foreigner residing abroad.—December 23; six months.

GEORGE THORNTON, of Brighton, Civil Engineer, for "*certain improvements applicable to railways, locomotive engines, and carriages.*—December 23; six months.

JOHN DICKINSON, of Bedford-row, Esq., for "*certain improvements in the manufacture of paper.*"—December 23; six months.

DAVID WALTHER, of Angel-court, Throgmorton-street, Merchant, for "*certain improvements in the methods of purifying vegetable and animal oils, fats, and tallows, in order to render those substances more suitable to soap-making, or for burning in lamps, or for other useful purposes, part of which improvements are also applicable to the purifying of the mineral oil or spirit commonly called petroleum or naphtha, or coal oil, or spirit of coal tar.*"—December 23; six months.

JOHN JONES, of Leeds, Brush Manufacturer, for "*improvements in carding engines for carding wool and other fibrous substances.*"—Communicated by a foreigner residing abroad. December 23; six months.

JOSEPH BARKER, of Regent-street, Artist, for "*improvements in gas meters.*"—December 23; six months.

TO CORRESPONDENTS.

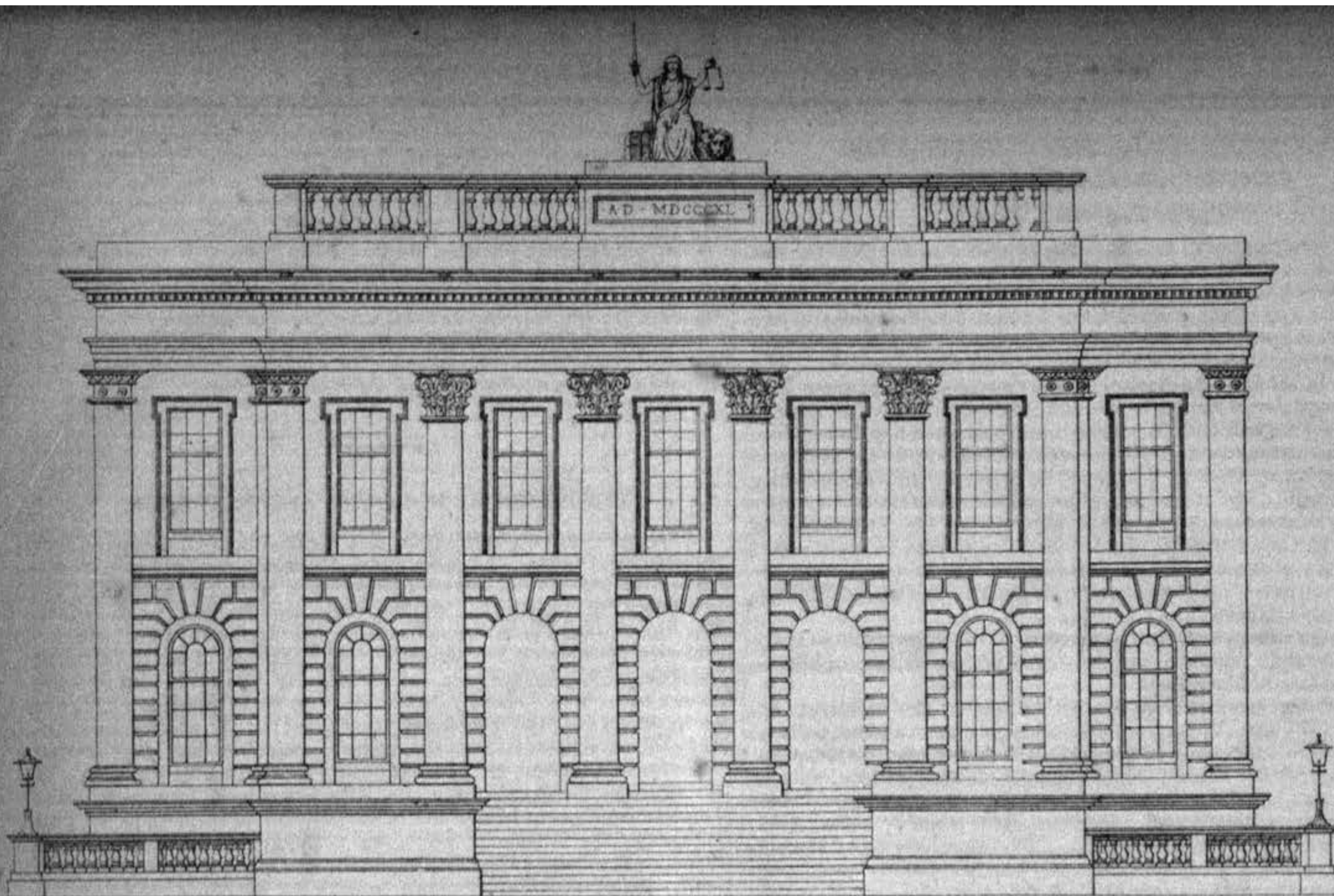
The drawings of the new town hall of Ashton-under-Lyne will appear next month.

Additional information on the Reform Club will be given when the building is entirely finished.

Communications are requested to be addressed to "The Editor of the Civil Engineer and Architect's Journal,' *No.* 11, *Parliament Street, Westminster.*

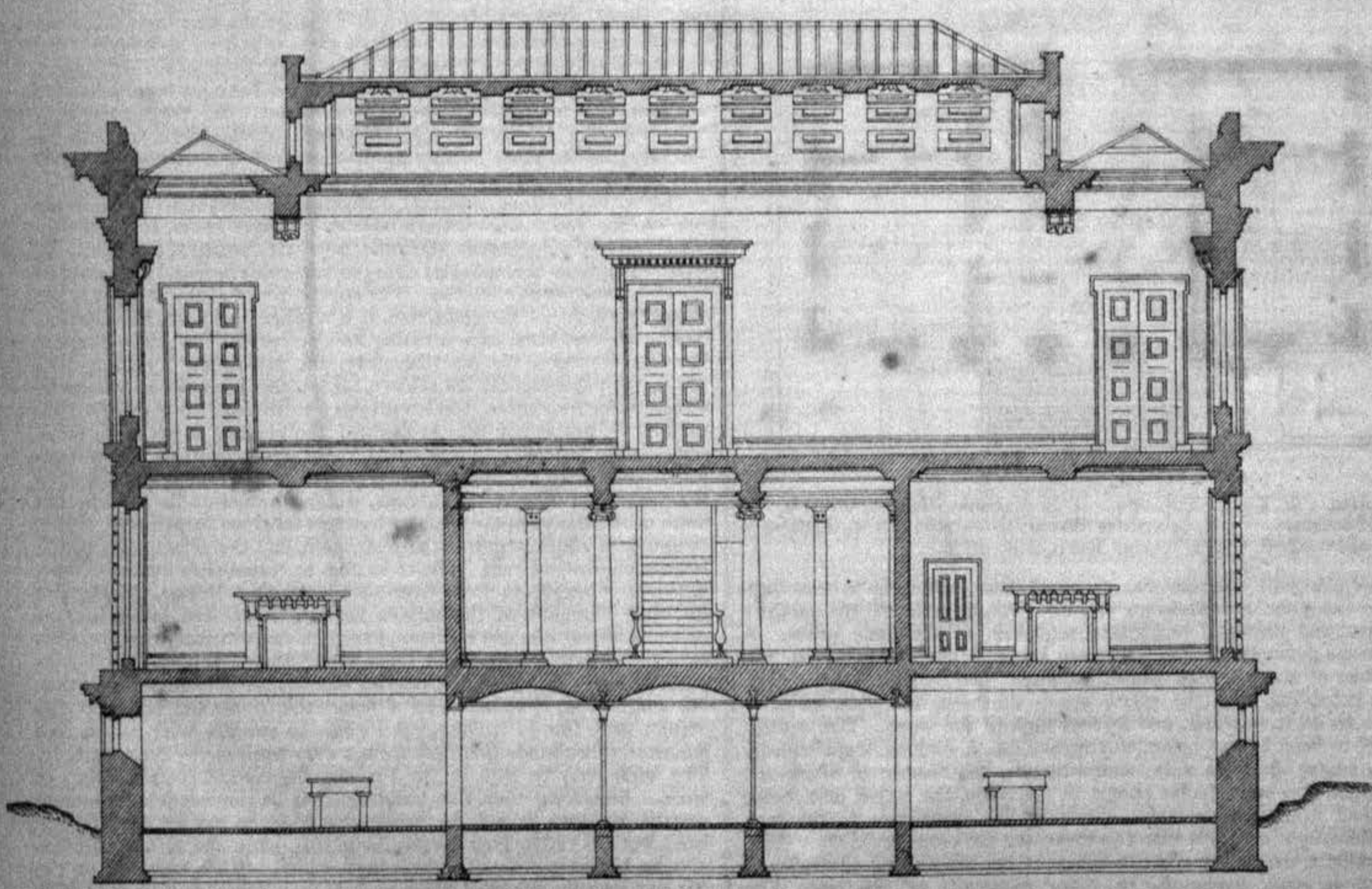
Books for review must be sent early in the month, communications on or before the 20th (if with drawings, earlier), and advertisements on or before the 25th instant.

Vols. I, II, and III, may be had, bound in cloth, price £1 each Volume.



ELEVATION OF NEW TOWN HALL, ASHTON UNDER LYNE.

YOUNG AND LEE, ARCHTS.



LONGITUDINAL SECTION.

SCALE OF FEET.

Jobbins lith.

NEW TOWN HALL, ASHTON-UNDER-LYNE.

ARCHITECTS, MESSRS. YOUNG AND LEE.

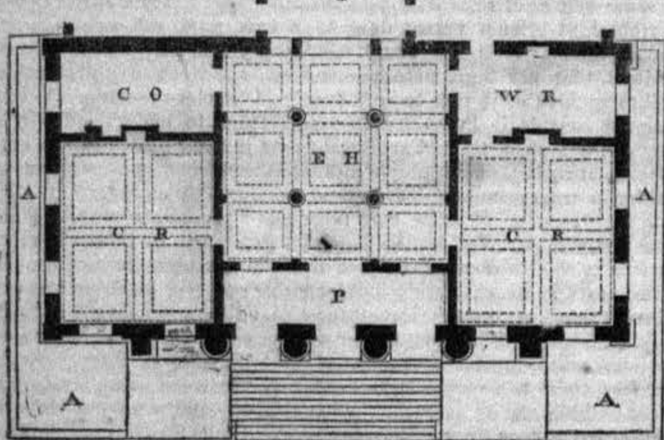
With an Engraving, Plate II.

A brief description of this building appeared in the No. for last July. It is in the Roman style of architecture, and consists in front of an attached Corinthian colonnade *in antis*, surmounted by a balustrade of the same order, which forms a parapet to the centre of the façade, and is crowned by a group of sculpture. The wings consist of a single interpilaster, and terminate above with a plain parapet. The two flanks of the building are alike; and consist simply of three windows in length, each similar to those in front, with antæ at the corners only. The attic wall with its cornice is also continued round the flanks. The internal arrangements, it will be seen, demanded that the front wall should form an uninterrupted line, and be pierced with windows along its entire length; and it was therefore considered preferable to have attached columns—an arrangement adopted in the Erectheium at Athens. The order itself is divided into two stories, and is elevated upon a lofty stylobate. Its proportions are chiefly taken from the Pantheon at Rome. A dentil cornice, instead of one with modillions, is used to save expense.

The design although making no pretensions to originality, is in keeping with the style adopted, and does credit to the architects, Messrs. Young and Lee of Manchester.

This building, erecting from designs by one of the architects engaged, Mr. William Young, of Manchester, is now on the point of being *roofed in*. It stands on the north side of the new market-place, Ashton-under-lyne; a town which, compared with its size, may be said to be rich in public and private buildings of importance. Many of these are of a very tasteful character, and certainly reflect great credit on the spirit of the inhabitants. The main portion of the edifice before us, being that shown on the plan, is entirely faced with tooled Ashlar, from the quarries of Saddleworth, in Lancashire, and the remainder of the building faced throughout, with stone from the neighbourhood, neatly hammer-dressed.

Ground Plan.



Scale 30 feet to an inch.

A, Area. P, Piazza, 33·0 × 8·6. E H, Entrance Hall, 33·0 × 31·0. S, part of Staircase. C R, Committee Rooms, 26·0 × 24·0. C O, Collector's Office, 13·0 × 24·0. W R, Waiting Room, 24·6 × 13·0.

The plan will describe the principal floor, which is 16 feet high in the clear, and comprises an entrance hall, approached by a *piazza* in front, and arranged as a triple colonnade of the Ionic order. A handsome geometrical stone staircase, 24′ × 21′ leads from this to the first floor of the building, whose principal feature is a large public room extending over the entire space shown in the plan, 83 ft. in length by 40 ft. in width, and 28 feet high to the cove. The ceiling, as will be seen by the accompanying section, is divided longitudinally into a centre and two side compartments, the former of which is a segmental *cove* with double panels or *lacunars*, the upper ones being enriched with open rosettes, screening the ventilators in the roof. To afford light and give effect to these and the members of the ceiling generally, a circular or wheel window of an ornamental character is placed in each *tympanum* or plane extremity of the *cove*. The cornice and fascia round the room are entirely plain, and where the latter crosses the ceiling transversely, dividing the three compartments before mentioned, ornamental brackets or cantilevers are introduced, connecting the soffit with the opposite walls. The doors and windows of the room are finished with architraves and cornices with plain consoles. Attached to it is a suite of ante and retiring rooms. It is intended for the use of public meetings, assemblies, &c., as well as for holding petty sessions; for this latter purpose it communicates on one side by a circular stone staircase with the police office on the ground floor, and a range of stone lock-ups in the basement. All the doors in the entrance hall and staircase, have architraves and cornices in keeping with the finishings of the large room. The whole of the timbers throughout are Kyanized. This building will be erected for *less* than the sum specified in the architects' estimate.

ENGINEERING HONOURS AND REWARDS.

It seems to be an admitted fact that England is, of all countries, that in which the fewest and most trifling honorary distinctions are conferred upon men of science—a proposition in which our readers are doubtless fully prepared to express their acquiescence, as one which they have always heard uncontroverted and deplored. For this cause our men of science have complained, and the policy of our government has been called in question, for certainly all history and experience attest to us that honorary distinctions are those rewards which are most grasped at, and most fiercely contended for. It was for a perishable crown of leaves from the neighbouring trees that kings entered the lists at Olympia, and Grecian heroes exerted all their powers. It is with such feeling that the man of science looks forward to a distinction which is to herald him in society, and to be perhaps the only reward of the labours of years, and of the greatest triumphs of the mind.—The astronomer, the geologist, the mathematician, the naturalist has few golden premiums to look forward to, a scanty professorship or a death-bed pension is the limit of his hopes, and he clings the more to a recompense which is but an acknowledgment of services, for which he can obtain no pay. The system is good, and we do not wonder that our countrymen strive for its extension, we are only surprised that they should make invidious comparisons as to their native land, when a little consideration would teach them that their lot is not so much to be contemned. Napoleon gave, it is true, his counties and his baronies, his grand crosses and his stars pretty liberally—the same may be said of other governments—now we have to ascertain what our own authorities have done in this respect. M. Arago complains most truly that we did not make Watt and others peers, but both he and most others seem neither to have reflected upon the reason for this omission, nor to have noticed what really has been done. Political power is one thing, honorary distinction another, and in no country that we are aware of, although isolated instances occur, is it a recognized principle to invest scientific men with political functions, for (with exceptions of course) no class perhaps could be found less adapted for their competent exercise. The special world of the student is not the great world of the politician, it is a sphere brilliant, but inferior, having its own laws, and pursuing its own revolutions. The chemist has been educated for his laboratory, the astronomer for his watch-tower, the naturalist for his cabinet, and so also must the politician be educated for his duties, and accustomed to their performance. This certainly is one reason why in England the peerage is not to be reckoned among scientific rewards, but there is also another, which however it may arise from prejudice, is equally authorised by precedent—the peerage of England is a rank, which whether it be held by the duke or the baron, in the scale of courts is received as princely, which coequalizes with the grandeeship of Spain, and the principality of the Roman empire—a rank similar in fact to Napoleon's dukes. Now, however it ought to have been—we know that Monge, Cuvier, and the other illuminati of the empire never were created dukes, but received a lower title, and were not, except in extraordinary cases, invested with political power. The ranks which they received, in the comparative scale of French and English society, are very little more than our knighthood, if so much, for although the counts and barons of the empire were few in number, yet France so swarms with counts and barons of other kinds that they form a very squirearchy for multitude. The same may be said of the Prussian barony and councillorship of state. Admitting then that knighthood is by precedent a competent reward, we think it will be found that England has not been behind hand, but has rather gone farther by giving, as in the case of baronetcies, an honorary title of even a higher kind. If we look only at the last half century, we shall find a multitude of distinctions given which in our opinion far outbalance any exertion of other nations. The law partakes so much of a political profession that we need scarcely allude

to the honours which devolve upon it, extending even to the peerage, in which it has founded so many great houses. Medicine is scarcely less cared for, as in one shape or another it has scarcely less at the present moment than a score of Sirs, many of them baronets, and since the commencement of the present century it has numbered more nearly half a hundred than any lower number. The artists come next in number, their president is always knighted, and their several departments of painting, sculpture, architecture and engraving have nothing to complain of, having half a score knighthoods among them, six in the Royal Academy. We will now skim over some of the other classes which at different times in the last fifty years have been noticed, and of course in such a list, we must be guilty of many omissions. We find of astronomers and philosophers Sir Joseph Banks, Bart., G.C.B. and Privy Councillor, Sir W. Herschel, Sir John Herschel, Bart., Sir James Hall, Bart., Sir David Brewster, Sir John Robison, &c.; of chemists, Sir Humphry Davy, Bart.; of naturalists, Sir James Edward Smith, Sir William Jackson Hooker, &c.; of agriculturists, Sir John Sinclair, Bart.; of musicians, Sir George Smart, Sir John Stevenson, &c. Antiquaries have as heralds and keepers of records political opportunities of promotion, and accordingly come off pretty well, they number Sir Wm. Woods, Sir W. Betham, Sir Harris Nicolas, Sir Nicolas Carlisle, Sir Henry Ellis, Sir Gardner Wilkinson, &c. Travellers and discovers also have a similar relation, and boast their Sir Edward Parry, C.B., Sir John Franklin, C.B., Sir John Ross, C.B., Sir Alexander Burnes, Sir James Alexander, &c. Literary men have not been so lucky, Sir Walter Scott's baronetcy being their principal.

We think we have thus run over a list which will satisfy any reasonable man that affairs are not so badly off in old England, and that in the country where William Cobbett rose from the *impasse* of the army to share in the legislation of the greatest empire of the world, that there is something to be looked forward to by every man who has talents to do good and diligence to exert them.

We have thus defended our authorities from the general charge of neglecting scientific rewards, but we cannot so easily acquit them of indifference towards a profession which has the fairest claim upon their attention. The military engineers come in with the rest of the army, the naval engineers have had their Sir Robert Seppings, and Sir Edward Symonds, but the civil engineers have received only one knighthood, and that too conferred for what was considered an architectural labour. We think that the profession has just ground to complain of this, they are rising in public estimation, possess good general rank, have performed most important public services, and yet have been passed over as to the most coveted reward. The Institute has received a royal charter, engineering is a recognized educational faculty, for which a regius professorship has been founded, honorary degrees have been conferred upon its members, and the president has received a seat in the senate of the great university of the empire, so that certainly as far as qualification goes, there is not the least ground for this holding back of favour. Two years ago we had to complain of this, and we are sorry to renew our murmurs now. In other professions there are certain defined offices, the holders of which generally receive honours, and we do not see why it should not be so with the engineers. The Presidents of the Royal Society have had a baronetcy, as also the President of the Royal Society of Edinburgh, the President of the Linnæan Society, and the President of the Royal Academy knighthood. The government lawyers, medical men, painters, sculptors, architects, musicians, heralds, naval engineers, &c., both in England and Ireland are generally knighted, so that so far from a precedent being wanted, an omission only seems necessary to be supplied. If we look at our triumphant progress in railways, bridges, steam navigation, &c., in which we are almost without rivals, we think that there can be no difficulty in selecting such of the authors of them as are fully deserving of any honour the government can bestow. We think the President of the Institute, and the government engineer both in England and Ireland should always be knighted, and we think the same honour should be conferred on the most distinguished railway and marine engineers.

James Watt has had more public statues erected to him than the Duke of Wellington. The nation has expressed its opinion, let its representatives confirm it.

A Cornish engine has been recently erected on the New Southwark Water Works, in the Battersea Fields, by Mr. W. West, and manufactured by Messrs. Harvey & Co., of Hayle Foundry, on the same principle as that erected by those gentlemen on the East London Water Works, at Old Ford, and described in the Journal. Her cylinder is 64 inch diameter, length of stroke 10¼ ft. in the cylinder, and 10 ft. in the pump, working a 32 inch plunger pole, with the patent valves by Messrs. Harvey & West, which are so constructed, and the operation so easy, that it would be difficult to persuade a common observer of the existence of a valve therein.

CANDIDUS'S NOTE-BOOK.

FASCICULUS XXIII.

"I must have liberty
Withal, as large a charter as the winds,
To blow on whom I please."

I. Speaking of Versailles, Theodore Hook says: "as to its extent, its galleries, its saloons and all that sort of thing, it is internally striking: but any thing more hideously frightful as a building—speaking of it architecturally—never was seen. The front, as you approach it from Paris, is indescribably mean. The garden front is bald and graceless—the associations connected with it, and the splendour of its internal decorations may and do give it a palatial character: but it is an exceedingly ugly affair." This criticism is not at all too severe, for the exterior is in fact the very maximum of littleness,—so far miraculous as it shows that it is possible to contrive a building of great extent and enormous cost that shall nevertheless be altogether destitute of effect, and possess no more grandeur—that is, artistical grandeur and dignity, than a huge barrack of the same size. So far Versailles well deserves to be styled—as it has been before now, one of the *wonders* of the world.

II. Among the qualifications usually insisted upon as requisite to an architect—of some of which, by the by, the necessity is not very apparent—we do not find enumerated the one which of all others would seem to be the most indispensable, that is, when we come to something more than mere building and construction, and consider architecture as a fine art. The qualification thus *accidentally* overlooked, as if it were the least important of any,—something which it is very well to possess, but which an architect can contrive to make shift without, is what for want of a definite term in our own language to express it, we must call "*Kunstsinn*," which word implies a good deal more than our English "*Taste*." It would seem that this and this alone distinguishes the architect from the builder—taking those names not in their professional and technical meaning, but in the sense of artist, and non-artist, or at best artist at second hand, a mere plodder who stands in the same degree of relationship to the other that a mechanical rhymer, a scribbler of Album verses does to a true poet, *cui mens divinior*. Heaven knows! it is not every one who confidently writes himself architect, that has legitimate pretensions, or indeed, any pretensions at all to such title, if it is to be taken in its nobler meaning. Which being the case, it is by no means very difficult to understand why so many of them affect to hold artistical talent in their profession so very cheap, treating it as something of an altogether secondary consideration. Nothing is more common than to hear such people exclaim "O! that is all mere matter of taste and opinion." Most true, yet it is not every one who can distinguish between good and bad taste,—much less who is able to display superior taste in his own productions. It is true, taste is not absolutely indispensable on every occasion; nevertheless it is of paramount importance in edifices laying claim to be considered works of fine art, for in such case wanting æsthetic value, they want what, in that character is most essential to them. So far therefore, there is a very material difference between being a most excellent builder and an accomplished architect—and master of the art: not that excellence in construction is no merit in itself, or one that may be dispensed with at pleasure, but it is one which is negative as far as the æsthetic value of an edifice is concerned. Health and strength of body do not constitute beauty: in themselves, indeed, they are more essential requisites, but still they are distinct qualities from the other, although they, to a certain extent, contribute to it. In like manner does good building—able construction contribute to the value of an architectural production, but it cannot be received as an equivalent for æsthetic beauty, where this latter exists not, or perhaps, is most obviously and offensively deficient. This distinction between the Useful—the Necessary, and the Beautiful ought never to be lost sight of; least of all in these our mechanical, engineering times, when they are apt to be confounded together; and when it not unfrequently happens that mere utility and economy alone are considered all in all, and all-sufficient; and taste to be something which it is as well to have as not, provided it comes of itself, and can be had without trouble, but which is not worth any study or pains to secure it.

III. Architects are somewhat unjust and inconsistent in depreciating a class of artists whom they themselves have called into existence, namely, those styling themselves Decorators; for the latter would certainly not possess the control they now do, were it not that the others have, in a manner, surrendered up to them one entire and certainly very important province of their own art,—that one, in fact, where

alone there is room for the display of aught like taste or invention in domestic architecture generally. On this last account, it might be thought that instead of neglecting—we might say abandoning, that particular department of architectural design, the profession would apply themselves to it more especially, as affording the majority of them almost the only opportunities they can hope for, of displaying any ability as artists. So very far, however, is it from being the case that, on the contrary, all relating to the interior arrangement and decoration of private houses, seems to be quite overlooked in an architect's professional studies, and treated as if scarcely belonging to them. Very rarely indeed is any subject whatever of the kind to be met with at any of the exhibitions at the Academy; while even those who publish designs expressly purporting to be studies of domestic architecture, and to furnish ideas for those who intend to build, are equally shy of submitting any examples of interior fitting up and embellishment, confining their attention, as far as interior is concerned, merely to adjustment of the plan; and again in regard to this last, satisfying themselves with doing no more than consulting ordinary convenience, and avoiding palpable defects; but without aiming at any thing further—at any kind of effect, either as regards the general distribution or the individual rooms. The consequence is that when the architect has completed his task, and taken his leave, the owner finds all in the rooms in his house—with the exception perhaps of vestibule and corridors—quite in an unfinished state—with bare, blank walls. Of course then the decorator—who perhaps may be no better than a mere paperhanger—must be called in, to give the finishing touches to the rooms, before the upholsterer comes in his turn, with his readymade taste:—and it is well if between decorator and upholsterer, the architecture—that is, supposing there to be any at all —is not fairly smothered. Architects—at least ninety-nine out of a hundred, will say that such finical matters as those of mere fitting up and ornament, do not at all belong to them, nor have formed any part of their studies. The consequence is that the whole department of taste in regard to such matters, is consigned over to a class of persons who have generally but a very poor stock of that article, and with whom what is most expensive of its kind, and the newest in its fashion, is always sure to be the tip-top of elegance.

ON THE STATE OF THE ARTS IN ITALY.

Brief Observations on the State of the Arts in Italy, with a short account of Cameo-cutting, Mosaic work, Pietra Dura, and also of some of the Domestic Arts and Mechanical Contrivances of the Italians. By CHARLES H. WILSON, Esq., Architect, Edinburgh, A.R.S.A., and M.S.A. *Read before the Society of Arts in Edinburgh, Nov. 1840, and printed in the Edinburgh New Philosophical Journal, for January 1841.*

I feel that I ought to apologise to the Society for bringing before it a paper of this nature, which contains no description of any new art or discovery, but which may rather be described as being little more than a *catalogue* of arts and practices, most of which are of great antiquity. I hope that such a paper may be deemed admissible. As far as my individual opinion goes, I would say that it would be very desirable if several papers were read every session containing as distinct accounts as could be obtained of the state of the arts and sciences, with reviews of the progress made in them in different Continental countries every year. That such papers would be useful in various points of view appears to me sufficiently obvious; those who have neither leisure nor opportunity to inquire for themselves would by this means obtain a great deal of valuable and interesting information; our efforts to excel in the arts and sciences would be stimulated; and, above all, I think that, whilst our national vanity would be advantageously chastened, feelings of respect and esteem, founded on a knowledge and just appreciation of the merits of other nations, would beyond all other influences lead to international amity. Feelings like these have already been happily nourished by the amicable intercourse of literati of different nations: the course which I advocate would tend to the further diffusion of such sentiments amongst all classes.

I cannot, without presumption, imagine for a moment that the paper which I now bring before you can deserve to be considered one of such a series. I went abroad at a very early age, and my time was entirely given up to the study of the art to which I had devoted myself, and which every thing around me tended to increase my love of. The collateral studies of the youthful artist are naturally those connected with his art, and are greatly more extensive in Italy, from many favourable circumstances, than in Scotland, and the brief allusion which I have made to them and to the time of life when I lived abroad, is meant as an apology for the meagreness of the details which I humbly bring under you notice.

Any comment on the political condition of Italy would be out of place in a paper to be read here, although a distinct apprehension of it would be necessary previously to any inquiry into the state of her arts and sciences, and also to enable us justly to appreciate the great merits of Italian philosophers and literati, who, despite of adverse circumstances, so greatly distinguish themselves; but to so slight a sketch of the *arts* of Italy as that I am about to offer, any lengthened observations are not so necessary. Whatever may be our opinion of Austrian principles of government, and of Austrian influence in Italy, all who have visited the Italian territories of that power, must, I think, acknowledge that Lombardy is greatly in advance of the independent states, and in no part of Europe, Scotland excepted, are there more numerous schools for the instruction of all classes of the people. As the traveller advances southward, with nominal independence political degradation increases, and the general character of the people is lowered. We can feel no other emotions than those of regret for the prostration of Italy; but if we examine into the customs of the Italians, we shall every where find expressive indications of ancient power and refinement, and pleasing proof that, where civilization and its attendant sciences and arts has once held extensive sway, advantages are secured of which it is almost impossible, or at any rate very difficult, to deprive a people.

I shall commence with a brief notice of the art of painting in Italy: this fine art has gradually declined, and there seems to be no indication at present of its recovery. It is trammelled by academic system. The Roman school is distinguished by a cold affectation of classic purity, and a want of energy and nature in all its productions; but, whilst we avoid the errors into which it has fallen, we should not allow these, and the difference of its practice from our own, to blind us to its good qualities; many Roman artists draw exceedingly well, and they evince this power in the large and fine cartoons which they are in the habit of executing before commencing a picture. But if the student in this country does not draw long enough, which I think is the case, the Italian student, in acquiring his mastery of the crayon, seems to forget that he is ever to use the brush; and the Italian artists rarely prove even tolerable colourists, whilst their prejudices as to the adoption of many necessary processes in painting, and which were unquestionably in use amongst their great predecessors, are invincible. This was illustrated in an amusing manner one day in the Florence gallery. An Italian artist was busy copying a Venetian picture, and my late friend Mr. James Irvine, happening to look at his work, remarked to him that he never could hope to imitate the brilliancy of the original without glazing. "I know that," said the Italian, "but I won't glaze."

At Florence, painting is in much the same state as at Rome; of late some artists have endeavoured to add richness in colour to the correctness of their drawing, but they have only succeeded in arranging on their pictures in brilliant juxtaposition rainbow colours, without attaining that harmonious effect which marks the works of their great predecessors. At Naples, painting is at a low ebb; at Genoa, lower still; at Venice, it is little better; but at Milan it reckons amongst its professors clever men in some departments of the art.

Fresco painting is still pursued in Italy, but with most success by the Germans. I wish to avail myself of this occasion to do homage to the extraordinary merits of the masters of this distinguished school; in looking on their works, we cannot but regret that greater encouragement is not given to the highest department of painting in this country; in those which are encouraged, our artists excel; and we may, I think, therefore, justly conclude that ability would soon be found to execute works of the noblest description.

Engraving may appropriately be considered after painting. You are all, doubtless, well acquainted with the great names which have lately marked the progress of this art in Italy; most of these distinguished artists are now dead. Several of Raphael Morghen's pupils are much esteemed, the best of whom are established at Milan; many very fine and important works have been lately finished or are now in progress. Messrs. Ludwig Gruner and Rusweigh, both Italianized Germans, promise to revive the style of Marc Antonio with success.

The Italian engravers are most successful in their works from historical pictures; but a practice which they follow is, in my opinion, calculated to prevent their imitating with fidelity the style and feeling of the artist whose production they copy. They engrave from highly finished chalk drawings copied from pictures by artists who devote themselves to this branch: however faithfully these may apparently copy, it is certain that their drawings will, to a certain extent, exhibit their peculiarities of mind and feeling, and, as the engraving must likewise so far be marked by the style of its author, the process is not favourable to the production of engravings of a faithful character.

It is but fair to mention that this practice is forced upon the Italian engraver, as he can neither transport gallery pictures nor frescoes to his study.

The landscape engravings of Italy are not successful. Frigid imitators of Woollet in general, their works are far inferior to those of that admirable master.

Sculpture is certainly the art which stands highest in Italy. Canova rescued it from the infamy into which it had sunk, and his genius at once raised it to excellence. If I say that that immortal artist has worthy successors amongst his countrymen, I express, as strongly as possible, a favourable opinion of the state of the art. If we are to term that the Roman school of sculpture which reckons amongst its professors all the great sculptors of various nations who make the Eternal City their fixed place of residence, then we must, I think, hold that it is the first school existing. England is worthily represented in that united school. I shall not venture upon any comparison between it and our present British school; but it is an important fact, and to its honour, that, before Canova resuscitated sculpture in Italy, England could boast a succession of very eminent sculptors. I may mention the estimation in which our great Flaxman is held in Italy. "Flaxman," said a distinguished artist to me on one occasion, "was the greatest sculptor the world has known since the time of the Greeks;" and this opinion is very general in Italy. I touched shortly on the state of painting in the different Italian capitals. I shall pursue the same course with sculpture, but more briefly still, merely remarking that, with one or two exceptions, there are no Italian sculptors of eminence out of Rome.

In connection with the arts of painting and sculpture, we may now consider mosaic work and cameo-cutting as practised in Rome. The art of mosaic work has been known in Rome since the days of the republic. The severe rulers of that period forbade the introduction of foreign marbles, and the republican mosaics are all in black and white. Under the empire the art was greatly improved, and not merely by the introduction of marbles of various colours, but by the invention of artificial stones, termed by the Italians *smalti*, which can be made of every variety of tint.

This art was never entirely lost. On the introduction of pictures into Christian temples, they were first made of mosaic; remaining specimens of these are rude, but profoundly interesting in a historical point of view. When art was restored in Italy, mosaic also was improved, but it attained its greatest perfection in the last and present century. Roman mosaic, as now practised, may be described as being the production of pictures by connecting together numerous minute pieces of coloured marble or artificial stones; these are attached to a ground of copper by means of a strong cement of gum mastic, and other materials, and are afterwards ground and polished as a stone would be to a perfectly level surface; by this art not only are ornaments made on a small scale, but pictures of the largest size are copied. In former times the largest cupolas of churches, and not unfrequently the entire walls, were encrusted with mosaic. The most remarkable modern works are the copies which have been executed of some of the most important works of the great masters for the altars in St. Peter's. These are in every respect perfect imitations of the originals; and when the originals, in spite of every care, must change and perish, these mosaics will still convey to distant ages a perfect idea of the triumphs of art achieved in the fifteenth century. The government manufactory in Rome occupies the apartments in the Vatican which were used as offices of the Inquisition. No copies are now made, but cases of *smalti* are shown, containing, it is said, 18,000 different tints. Twenty years were employed in making one of the copies I have mentioned. The pieces of mosaic vary in size from an eighth to a sixteenth of an inch, and eleven men were employed for that time on each picture.

A great improvement was introduced into the art in 1775 by the Signor Raffaelli, who thought of preparing the *smalti* in what may be termed fine threads. The pastes or *smalti* are manufactured at Venice in the shape of crayons, or like sticks of sealing-wax, and are afterwards drawn out by the workman at a blow-pipe, into the thickness he requires, often almost to a hair, and now seldom thicker than the finest grass stalk. For tables and large articles, of course, the pieces are thicker; but the beauty of the workmanship, the soft gradation of the tints, and the cost, depend upon the minuteness of the pieces, and the skill displayed by the artist. A ruin, a group of flowers or figures, will employ a good artist about two months when only two inches square, and a specimen of such a description costs from 5*l*. to 20*l*., according to the execution; a landscape, six inches by four, would require eighteen months, and would cost from forty to fifty pounds. This will strike you as no adequate remuneration for the time bestowed. The finest ornaments for a lady, consisting of necklace, ear-rings, and brooch, cost forty pounds. For a picture of Paestum, eight feet long, and twenty inches broad, on which four men were occupied for three years, 1,000*l*. sterling was asked.

I shall now notice the mosaic work of Florence, before touching on cameo-cutting. It differs entirely from Roman mosaic, being composed of stones inserted in comparatively large masses; it is called work in *pietra dura*. The stones used are all more or less of a rare and precious nature. In old specimens the most beautiful works are those in which the designs are of an arabesque character. The most remarkable specimen of this description of pietra dura is an octagonal table in the *Gabinetto di Baroccio*, in the Florence Gallery. It is valued at 20,000*l*. sterling, and was commenced in 1623 by Jacopo Datelli, from designs by Ligozzi. Twenty-two artists worked upon it without interruption till it was terminated in the year 1649. Attempts at landscapes, and the imitation of natural objects, were usually failures in former times,—mere works of labour, which did not attain their object; but of late works have been produced in this art, in which are represented groups of flowers and fruit, vases, musical instruments, and other compatible objects, with a truth and beauty which excite the utmost admiration and surprise. These pictures in stone are, however, enormously expensive, and can only be seen in the palaces of the great. Two tables in the Palazzo Pitti are valued at 7,000*l*., and this price is by no means excessive. These are of modern design, on a ground of porphyry, and ten men were employed for four years on one of them, and a spot is pointed out, not more than three inches square, on which a man had worked for ten months. But Florentine mosaic, like that of Rome, is not merely used for cabinets, tables, or other ornamental articles; the walls of the spacious chapel which is used as the burial-place of the reigning family at Florence are lined with pietra dura, realizing the gem-encrusted halls of the Arabian tales. Roman mosaic, as we have seen, is of great value as an ally to art; but Florentine mosaic can have no such pretensions, and time and money might be better bestowed. The effect is far from pleasing in the chapel I have alluded to, and I think that the art might be advantageously confined to the production of small ornaments, for which it is eminently adapted.

An imitation of the pietra dura is now made to a great extent in Derbyshire, where the Duke of Devonshire's black marble, said to be quite equal to the famous Nero Antico, is inlaid with malachite, Derbyshire spars, and other stones; but the inlaying is only by veneers, and not done in the solid as at Florence. This, with the softness of the materials, makes the Derbyshire work much cheaper, and yet for a table, twenty to twenty-four inches in diameter, thirty guineas is asked. Were a little more taste in design and skill in execution shewn, the Derbyshire work might deserve to be more valued, as the materials, especially the black marble, are beautiful.

I shall now return to cameo-cutting. This art is also of great antiquity, and is pursued with most success in Rome, where there are several very eminent artists now living. Cameos are of two descriptions, those cut in stone, or *pietra dura*, and those cut in shell. Of the first, the value depends on the stone, as well as in the excellence of the work. The stones most prized now are the oriental onyx and the sardonyx, the former black and white in parallel layers, the latter cornelian, brown and white; and when stones of four or five layers of distinct shades or colours can be procured, the value is proportionably raised, provided always that the layers be so thin as to be manageable in cutting the cameo so as to make the various parts harmonize. For example, in a head of Minerva, if well wrought out of a stone of four shades, the ground should be dark grey, the face light, the bust and helmet black, and the crest over the helmet brownish or grey. Next to such varieties of shades and layers, those stones are valuable in which two layers occur of black and white of regular breadth. Except on such oriental stones no good artist will now bestow his time; but, till the beginning of this century, less attention was bestowed on materials, so that beautiful middle-age and modern cameos may be found on German agates, whose colours are generally only two shades of grey, or a cream and a milk-white, and these not unfrequently cloudy. The best artist in Rome in *pietra dura* is the Signor Girometti, who has executed eight cameos of various sizes, from 1¼ to 3½ inches in diameter, on picked stones of several layers, the subjects being from the antique. These form a set of specimens, for which he asks 3,000*l*. sterling. A single cameo of good brooch size, and of two colours, costs 22*l*. Portraits in stone by those excellent artists Diez and Saulini may be had for 10*l*. These cameos are all wrought by a lathe with pointed instruments of steel, and by means of diamond dust.

Shell cameos are cut from large shells found on the African and Brazilian coasts, and generally show only two layers, the ground being either a pale coffee-colour or a deep reddish-orange; the latter is most prized. The subject is cut with little steel chisels out of the white portion of the shell. A fine shell is worth a guinea in Rome. Copies from the antique, original designs, and portraits, are executed in the

most exquisite style of finish, and perfect in contour and taste, and it may be said that the Roman artists have attained perfection in this beautiful art. Good shell cameos may be had at from 1*l.* to 5*l.* for heads, 3*l.* to 4*l.* for the finest large brooches, a comb costs 10*l.*, and a complete set of necklace, ear-rings, and brooch cost 21*l.* A portrait can be executed for 4*l.* or 5*l.*, according to workmanship.

Having now touched upon those minor arts which have an intimate connection with painting and sculpture, I shall make a few observations on architecture, and the constructive and decorative arts which are connected with that science, but this I must do very briefly indeed, as otherwise I should occupy too much of the time of the Society.

The architects of Italy have but little scope for a display of ability, as the population is not on the increase, but, on the contrary, except in parts of the Austrian States, has shrunk away from the number required to occupy the palaces, villas, and houses which already exist both in town and country; and this is painfully proved by the number of empty and dilapidated edifices. The various buildings which belong to Government, the churches, colleges, and hospitals, have generally been built on a scale of magnificence which has never been excelled, in some instances never equalled, in other countries, but all betoken more or less the same melancholy decline. By this observation I do not mean to convey the idea that the buildings themselves are ruined or neglected; I allude to their emptiness, and to the absence of that state which once filled them with its splendour. To her honour, the hospitals of Italy have long been known for their number, extent, and order, and these are still models in many respects. Although not *many* works, yet some of great magnitude are going on in Italy, and in these taste in design, magnificence in material, and solidity of construction, are displayed. The restoration of the Basilica of St. Paul's at Rome is an immense undertaking; to effect it, contributions have been obtained from all countries, whether in money or materials. It is said that George the Fourth subscribed; and I may mention that the façade of another church in the Eternal City has been built at that sovereign's expense, in a way which he must little have anticipated. When the celebrated Gonsalvi visited England, his Majesty presented him with a magnificent snuff-box, which the cardinal in his will directed to be sold, and the proceeds applied to put a front on a church which had for a long time been unfinished in that respect.

The passion which all pontiffs have displayed for building still animates the less potent holders of St. Peter's chair of our day; and although inhabiting a palace which contains twenty-two court-yards, twelve halls of entrance, twenty-two grand stair-cases, and thirteen hundred of various descriptions; two large chapels, and eleven thousand rooms and galleries, in which miles may be walked without returning on the steps, yet each succeeding pope adds or alters, or marks repairs with his sculptured coat of arms.

Although there is not much employment for architects in Italy, there can be no question of the skill displayed in erecting their designs. The masonry is excellent, and the ancient Roman brick-work is rivalled by that of the present generation; houses are built of brick, in which all the exterior decorations are moulded in that material as perfectly as if executed in stone. The skill with which the Italian workmen build in brick may be exemplified by a notice of the Florentine practice of arching over rooms without centering of any description. Two thin moulds of board, the shape of the intended arch, alone are used; these are placed at each end of the apartment which it is intended to cover in, and pieces of string are stretched from the one to the other, guiding the workman as he advances in the formation of his arch, which he builds, uniting the bricks by their thin edges (greatly thinner than in those we use), and trusting entirely to the tenacity and quick setting of the cement.

Plastering is carried to a perfection in Italy of which we have, I believe, no idea in this country; rooms are so exquisitely finished, that no additional work in the shape of house-painting is required, the polish of the plaster and its evenness of tint rivalling fine porcelain. At times the surface of the plaster is fluted, or various designs are executed in *intaglio* upon it, in the most beautiful manner. Scagliola, a very fine preparation from gypsum, is the material chiefly used.

As an instance of the cheap rate at which this work is done, I may mention the new ball-room in the Palazzo Pitti, grand-ducal residence at Florence, which, including mouldings, figures, bas-reliefs, and ornaments, was executed at a cost of two crowns for every four feet square.

Work in scagliola naturally follows in my notice of the arts of architectural decoration; but this I need not decribe, as the art is now practised in England with great success, and an artist has lately settled in Edinburgh, whom I earnestly hope may meet with encouragement. A most beautiful art may be mentioned here in connection with the last, I mean that of making what are termed Venetian pavements which might advantageously be introduced into this country. The floors of rooms are finished with this pavement, as it is somewhat incongruously termed, and I shall briefly descriqe the mode of operation in making these, but must first observe that they are usually formed over vaults. In the first place, a foundation is laid of lime mixed with *pozzolana* and small pieces of broken stone; this is in fact a sort of concrete, which must be well beaten and levelled. When this is perfectly dry, a fine paste, as it is termed by the Italians, must be made of lime, *pozzolana*, and sand: a yellow sand is used which tinges the mixture; this is carefully spread to a depth of one or two inches, according to circumstances. Over this is laid a layer of irregularly broken minute pieces of marble of different colours, and if it is wished, these can be arranged in patterns. After the paste is completely covered with pieces of marble, men proceed to beat the floor with large and heavy tools made for the purpose; when the whole has been beaten into a compact mass, the paste appearing above the pieces of marble, it is left to harden. It is then rubbed smooth with fine grained stones, and is finally brought to a high polish with emery powder, marble-dust, and, lastly, boiled oil rubbed on with flannel.

This makes a durable and very beautiful floor, which in this country would be well adapted for halls, conservatories, and other buildings. In connection with the arts which the architect summons to his aid, I shall now notice that of ornamental sculpture; and here again we must acknowledge the superior skill of the Italians. The chief encouragement to artists of this description, is that given by foreigners, especially by English travellers in Italy. Copies of ancient sculptures, vases, chimney-pieces, and other ornamental articles, are executed in the most perfect manner, and at a very cheap rate. Such is the skill of the Italian workmen, that a native of Carrara actually cut a bird-cage in marble, which he presented to his sovereign the Duke of Modena, who, by the return he made, rather showed his sense of the folly of the sculptor, than of his patient perseverance in the production of so useless a specimen of his skill.

But whilst the sculptor displays his skill in these comparatively trifling departments, he is equally successful in the execution of architectural details on the most gigantic scale, whether in solid marble or in veneer. By this latter art he produces magnificent columns plain and fluted, the core of which is of coarse stone, but the joining of the marble-coating is so perfect that the finished pillar seems a mass of solid marble. The marble is attached in a rough state to the core by means of a cement composed of resin and marble dust, which is so tenacious that it admits of the hammering, chiselling, and polishing necessary in finishing the work. By means of this system of veneering, the interior walls of churches and other buildings are encrusted with rich and varied marbles, and tables and other articles of furniture are manufactured at a very cheap rate. The art which I have just described is, in fact, that of pietra dura on a gigantic scale.

With the sculpture of the Italians in alabaster, you must be all acquainted. This art is chiefly practised at Pisa, Florence, and Leghorn. The material, besides being used in sculpture, is ingeniously applied in Rome to the manufacture of false pearls. The pieces of alabaster, after being turned and filed into the proper shape, are enveloped in a brilliant paste, made with the scales of a very small fish found near the shores of the Mediterranean.

To return to the subsidiary arts of architecture, I may remark that the carpentry of the Italians, as observable in ordinary houses, displays little skill and indifferent workmanship; but in the roofs and floors of important buildings, they satisfactorily prove their knowledge of scientific principles, and several of their designs are well known to British architects.

With regard to the working of iron, in comparison with our system the Italian is primitive indeed; yet at times they can and do produce very good specimens of workmanship, but at a heavy cost; consequently they are generally content with very ordinary productions. A manufactory of wire, and of driving and screw nails, by means of machinery, *now occupies the villa of Mecœnas at Tivoli*; the articles produced are very well made. Copper is extensively used in Italy, and there are productive mines in the *Maremma Toscana*. The workmanship of articles made of this metal is respectable; various utensils are made of brass in a very neat and satisfactory manner, but in the interior finishing of houses, if much nicety is required, articles of foreign manufacture are used.

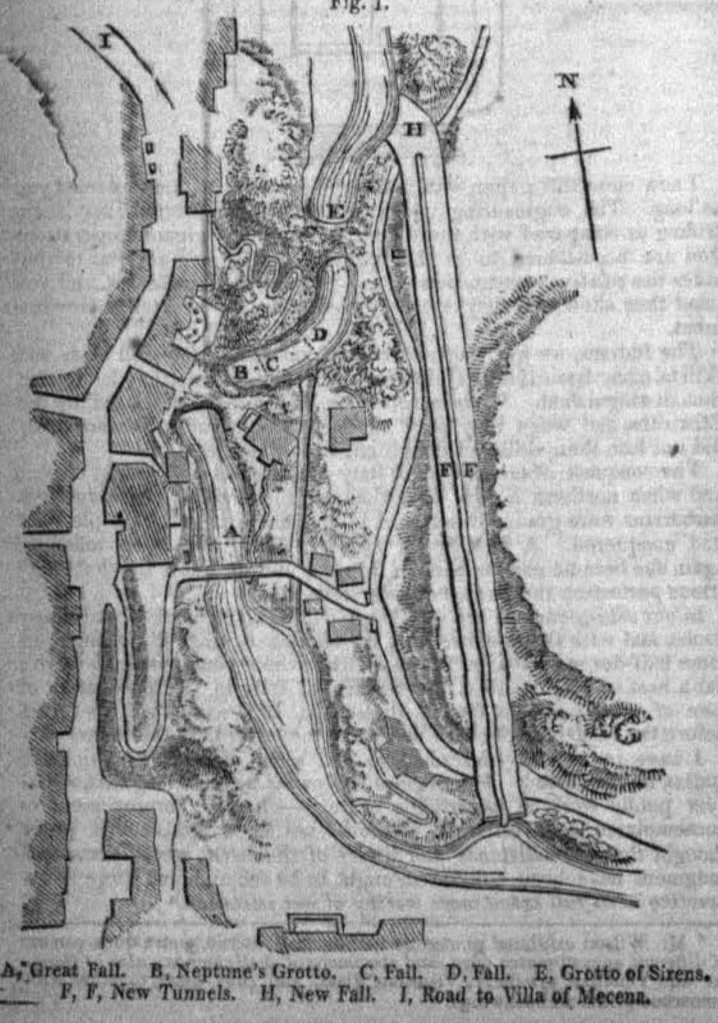
House-painters may be mentioned in the last place, and these display much taste and skill; and there is a class of them who greatly excel those in this country, having more fine feeling and taste of artists. Surrounded by the finest models in this art, the Italian decorator enjoys every advantage in its study, and he inherits besides from the best periods of art, or rather from all antiquity, taste and a good system of workmanship. He is not a mere machine like the workman in this country, who has little use for an intellect beyond

enabling him to use his moulds, stamps, and the various mechanical contrivances which confine all our decorative arts within such common-place limits.

In all our architectural drawings and engravings, we find a vigorous artist-like style, which is reflected in the works done from them. In the architectural engravings of the present day, every thing is sacrificed to a display of dexterity in the use of the burin; the spirit of the original ornaments is never represented. How strongly this is illustrated, for example, in our engravings from Etruscan vases! Works executed from such engravings, or from drawings like them, are naturally stiff and lifeless like the models. People who possess a feeling of taste, dissatisfied with such productions, seek to replace them with older specimens, and amongst other things very inconvenient carved chairs and tables, in the workmanship of which they find a pleasure in tracing the influence of mind. But the cleverness in the workmanship of these specimens has greatly misled the taste of the day; and the abominations of Elizabethan architecture, lately dignified with the name of the *Renaissance* style, of which however it is a mere caricature, the extravagances of the Louis XIV. and XV. eras, or the debonnaire barbarisms of Watteau, have contributed to the banishment of a healthy taste in style. To restore a feeling for better art, the purer styles of classic or Gothic art must again be executed in the spirit of better times, and to grace of form must be added feeling in execution.

I shall now turn to the engineering works of Italy, a subject worthy of much attention, but on which I regret to say I am able to say very little indeed. The greatest works I saw going on were those at Tivoli, and from the Ombrone to the Lake of Castiglione in the Tuscan Maremma. I shall merely offer a very brief description of these works, necessarily very imperfect, as I write entirely from memory. The Tiber or Anicne, on reaching Tivoli, was dammed up by the architect Bernini; precipitating itself over the lofty barrier he raised, it disappeared under the rocks on which the town is built, and was seen again in the celebrated grotto of Neptune; rushing out of this remarkable cavern it fell into another abyss, and again vanished into the grotto of the Sirens, from whence it issued in the deep valley under Tivoli, several hundred feet below its original level. The pencils of the painters of every nation have been employed for centuries with this,

Fig. 1.



A, Great Fall. B, Neptune's Grotto. C, Fall. D, Fall. E, Grotto of Sirens. F, F, New Tunnels. H, New Fall. I, Road to Villa of Mecena.

I may say, terrible scenery, this *orrido bello*, of the falls of Tivoli. They may now depict the rocks, but the waters are gone for ever. Some years ago, Bernini's dam was carried away in a flood; it was rebuilt by the Pope's engineers, but if I remember aright the river got the better of them and threw down their work; at last they dammed up old Tiber, and made the very ugliest waterfall that ever unfortunate artist contemplated. It was now discovered that the river, in passing through Neptune's grotto, had worn away the rocks in such a manner that the town and its temple depended on a rugged pillar, the duration of which could not be calculated upon. To prevent the town paying a visit to the Sirens beneath, it was resolved to turn the river, and it will be acknowledged that this was a bold undertaking; walled in by mountains, it sought a passage under them; and to a certain extent imitating the operations of nature, the engineers have carried the river through two parallel tunnels, and tumbled it into the valley beyond the Sirens' grotto over a bank twice or perhaps three times as high as the Caston hill. The engineers have saved Tivoli, but its romantic beauty, as far as the river is concerned, is gone for ever.

The other engineering work which I mentioned, namely, the canal from the Ombrone to the Lake of Castiglione, has excited much interest. The Lake of Castiglione, anciently the Lacus Prilis, falling very low in summer, left much marshy ground uncovered, in which were numerous stagnant pools, and quantities of putrid herbage, making the air poisonous in hot weather, and breeding myriads of noxious insects. To remedy these evils, Leopold the First ordered his architect Ximenes to make a canal from the river Ombrone to the lake; by this means it was intended to keep the latter constantly at the same level. This work was finally executed by the present Grand Duke in the year 1830, and by means of a canal seven miles long and twenty-five feet broad, a sufficiency of water is supplied to keep the lake at a proper level; so sufficient indeed was the supply that the whole surrounding country was overflowed the first year, but this has been remedied. The air it is said has been improved; but when I visited Castiglione in 1832, I found that all who could left it in the summer months, and all who remained had the fever. Some notice may be expected from me of the engineering works in the Pontine marshes; but like other British travellers, I have only galloped through them, and have merely to state that the attempts to drain them cost a million of money.

The roads in the north of Italy are excellent, and indeed generally throughout the Peninsula; although a small portion comparatively of the country is intersected by roads; and I have travelled many miles over turf, or by small mule tracks, both on the coast and in the mountains. Towns are almost universally built on eminences; consequently the roads are hilly, but I think less so than would be supposed from the nature of the country, and both in direction and in smoothness, they greatly excel those of France.

The system of road-making followed is nearly the same as that adopted by the late Mr. Telford, that is to say, a pavement of stones is first formed upon which the metal is laid; but I do not think that the principles advocated by our great engineer are followed out in the formation of the pavement. Excellent roads, however, are the result of the system, even although gravel is used instead of broken metal.*

Various principles of paving are now exciting much attention in London; it is to be regretted that something like a sensible principle is not followed in Edinburgh. In Italy various mode are adopted, in Genoa und at Naples large flat parallelograms of lava are used, at Florence large irregular polygons carefully jointed, and at Rome a pavement resembling our own, except that the stones are of irregular forms, of one size, and grouted in with lime and *pozzolana*.

I shall now touch very briefly on a few arts of Italy which remain to be described, and shall then take the liberty of bringing before you one or two contrivances which struck me as ingenious and of which I have prepared drawings.

The goldsmiths of Italy produce ornaments which are both remarkable for taste and workmanship, especially those of Genoa ond Venice. I am enabled to show you some trifling specimens which our workmen cannot equal.

After the goldsmiths I may mention the makers of bronze ornaments and figures; this is an art in which the Italians show much taste and dexterity, so much dexterity indeed that they sell numbers of antique

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* I have not seen the railroad which has been lately made from Naples to Castellamare, but am well acquainted with the line; a novel question in engineering must arise in considering how it is to be protected from the lava of Vesuvius. This I believe will not be very difficult, but it has a more insidious enemy in the earthquake, and a more overwhelming one in the showers of scoriæ and ashes which accompany an eruption.

Railways may be useful in Italy to promote her commercial prosperity, but I pity the man who could think of travelling in such a manner through any part of that country.

bronzes of modern fabric yearly to *soi-disant* antiquaries, who, however, neither possess that extensive learning nor profound experience and correct taste necessary to constitute such a character. It is much the practice in Rome to take moulds from real lizards and to cast them in bronze; these make very pretty ornaments for the table. I regret that I am unable to give you an idea of the value set upon these works.

The manufacture of glass is pursued with great success in Venice: the numerous glass ornaments for ladies which come thence are well known, and the endless varieties of form and combinations of colour given to glass beads for rosaries and embroidery, or vessels for domestic use, are very ingenious and beautiful. The ruby glass of the 1500 and 1600 can now be imitated so as to make imposition a famous trade, the false being only distinguishable by weight. Glasses are also made in which white threadlike lines of arsenic are incorporated. The process by which they make sheet-glass differs from ours. Instead of being formed into immense circular sheets, the Venetian workman blows cylinders of considerable length and diameter; he then cuts off the two ends of his cylinder, dexterously slits it down one side, and spreads it flat on a table in an oven. By this process sheets of a sufficient size are made, and there is no loss as in those fabricated in this country.

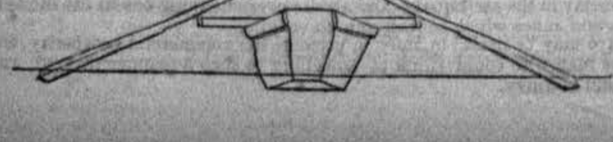
I think that I have lately observed that the process which I have thus briefly described is practised at some manufactory in England.

The velvets of Genoa, and the exquisitely turned ware of the same place, the straw hats of Tuscany, the silks of Florence, the embroideries of Rome, the musical instruments and musical strings, and although last not least, the maccaroni, of Naples, are all samples of skill creditable to the Italians.

I shall now request your attention to this lithograph of a triumphal arch. This is a specimen of an art in which the Italians display both taste and great ingenuity, and which seems to me deserving of notice, for although it may be deemed useless by some, yet it contributes largely to their happiness. I allude to their preparations for festivals and pageants. Without entering into any description of these, I shall content myself with exhibiting a print of a triumphal arch erected at Tivoli on the occasion of a visit from his Holiness the Pope. Erections of this description are put up in a day or two, being formed of a frame work of wood, covered with coarse canvass painted in imitation of stone. The bas-reliefs are of stucco, and the statues are formed of straw, arranged round wooden supports; casts of heads, hands, and feet are easily procured and attached. This *anima* (soul), as it is termed, is skilfully enveloped in drapery of cotton cloth, which is tastefully arranged by an artist, ond is then lightly brushed over with white-wash, which stiffens it. That a knowledge of the art displayed in erecting this arch may be useful, may I think be proved, by an allusion to the gallows-like erection under which his Majesty George IV. passed when he entered Edinburgh.

In the summer of 1833 I made a journey from Leghorn to Rome along the coast, a *terra incognita* to most travellers, my object being to trace the Via Aurelia. At Orbetello, the last town in the Tuscan States, besides making some interesting antiquarian discoveries, I observed the boats which I am about to describe. Orbetello stands upon a peninsula, projecting into a shalluw lagoon of some extent; the boats which are used upon it, are flat-bottomed, rise considerably at the bow and stern, being lowest at midships, across which part of the vessel a beam is fastened, about four inches thick each way, and which projects about two feet six inches over each side. On each of the ends of this beam an oblong piece of plank is nailed, the longest sides being horizontal, and a stout pin rises from each of these. The oars are of considerable length in proportion of the boat, and of great breadth in the blade. The oars rest upon the pieces of board at the ends of the cross-beam, being attached to the pin by means of a piece of cord, in this last respect resembling a mode adopted in boats on our own coasts. The blade of the oar slightly overbalances the portion within the fulcrum on which it rests, the handles nearly touch each other, meeting a-midship. By this contrivance, one man can manage a pair of very powerful oars, and can drive a boat, which is apparently but ill adapted from its form for speed, with surprising rapidity through the water; can arrest its progress, or turn it with equal rapidity and certainty, and with very little exertion. The annexed engraving is a transverse view of one of the boats.

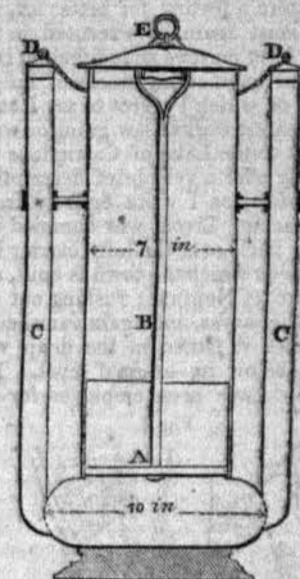
Fig. 2.



My knowledge of boats and ships is indeed very trifling, but I could not help seeing how easily the fisher of Orbetello manœuvred his rude boat; and therefore I have been induced to bring forward this notice of a vessel and mode of rowing which I am not aware has been described. Besides, it suggests ideas as to the probable mode in which the ancients managed their triremes, well worthy the attention of the antiquary, especially if he will combine the hint thus obtained with the modes of rowing followed in the Bay of Naples on board the Sorrentine boats, which, I have been led to imagine from an examination of pictures in Pompeii, are much the same in every respect as the galleys which in old times navigated the same sea.

My next drawing represents (fig. 3), by means of a section, an apparatus used in Italy for warming baths. I need not describe it, but shall merely observe generally, that it is made of copper; the live charcoal is put upon the grating A, which is put into the stove by means of the handle B, the fire is kept alive by air supplied through the tubes C C, 7 inches diameter, and when immersed in the water of a slipper-bath, this light and portable apparatus will heat it in a quarter of an hour. I think it might be useful in this country.

Fig. 3.



I now close this paper with many apologies for having detained you so long. The engineering works I have briefly described may seem trifling as compared with those extraordinary and gigantic operations you are accustomed to in this country; but I would ask you to consider the relative extent, power, and resources of the states, and you must then allow that they are very creditable to the Italian Government.

The Italians, we have seen, are still remarkable for their taste and skill in many beautiful arts, and for nearly 3000 years they have been thus distinguished. Various arts were successfully practised by the Etruscans, and when they were subdued by the ruder Romans, they did not lose their skill, but enlightened their masters.

The conquest of Greece filled Italy with artists and works of art; and when northern hordes overwhelmed the empire, these ruthless barbarians were gradually softened by the fine arts of the people they had conquered. A new power arose in Italy, and by its influence again she became pre-eminent in Europe, and we know to what illustrious perfection the fine arts again attained.

In our sale-rooms we see sold every winter many cracked and dingy daubs, and with these before him, the auctioneer rings the changes on some half-dozen names, as if the Italian school could boast no more; but a host of artists attest the fertility of Italy in the production of men of talent; and in Lanzi's dictionary, 1000 names will be found before the reader reaches the middle of the letter D in the index.

I have imperfectly described to you some of the arts which the Italian has inherited. I shall close this paper by observing that, whatever public work is undertaken in Italy—wherever improvement is contemplated, even although it should not be extensive, it is justly thought that the assistance and advice of the artist, whose taste and judgment have been cultivated, ought to be secured, and there is no practice in its full extent more worthy of our imitation.*

* Mr. Wilson exhibited numerous specimens of mosaic, pietra dura, cameos of different ages in pietra dura, and specimens of shell cameos; also of Genoese and Venetian jewellery, Venetian glass, and ruby glass, together with numerous prints and drawings.

ON THE STYLE OF BURLINGTON AS COMPARED WITH THAT OF PALLADIO.

Architecture and its relics betray the character of a people; an evidence in themselves of national credit or misrule, they shed a pleasing truth upon the record of history; for there is a link between the feudal castle and vassallage, between the stately palace and increasing revenue or commerce, between the more modest villa and a privileged community. Carrying our minds, then, with this pleasing idea, from the castle and the monastery, down to the 17th century, when Gothic began to yield to the influences of Italian art, we observe one architect whose talents, united to rank, justly merit our notice. Comparing him with his great master, we may, perhaps, lessen his claim to originality; but as a disciple of Palladio, he will ever appear, for the age in which he lived, an architect of refined taste and of elegant mind.

Burlington, aiming after Palladio and yet captivated by Jones, stands distinguished from both, mingling, as he does, a little from the richness of the latter, with the more grave simplicity of the former. Tamer in his conceptions, the elevation displays nothing of that intricacy of parts, or of changing features, resolved and blended into one harmonious whole as in Jones:—his unity is the whole, whilst his parts are fewer. No studied appropriation of ornament compels the eye to any particular part, no lofty feature rises to dignify. The feeling of the artist is never led astray into any redundancy—all is depressed, though carefully disposed. It cannot be said that he is grand, for that excellence is destroyed by uniformity; nor can it be said that he is mean, for his variety, though scanty, is made up of parts as much as of detail. He has his partialities, however, and loves the colonnade, through the openings of which he permits you to see his statues. Of statues, however, as of columns, he is very sparing, and seldom exhibits the former prominently except on the second story. Sufficiently alive to the sentiment of Palladio, he never wearies but always carries you pleased to the wings of the façade:—but, with here and there the introduction of a balustrade, the relief of a figure, or a special window at the wings, he is content. As an architect we must admire him more for his care than for his ingenuity, more for his adherence to the existing rules of harmony, than for that poetic sentiment, that brilliancy of idea, ever indulging though ever beautiful, displaying features ever new and yet ever subordinate.

Turning now to the Italian, let us mark his excellencies, which (being imitated by Burlington), when seen, will show how far he identified himself with the genius of his master. To say nothing of the talent which could change the features of his country's art, by investing it with charms both new and various, we might regard him merely as the vigorous restorer of ancient beauty. But, uniting the most suspicious care with the deepest enthusiasm, this master of combinations, this genius of distribution, swelled the proportions and increased the grandeur of design by a system original and true. Friendly to the pedant whilst studying at Rome, but superior to the pedant in his conceits and imaginings, Palladio allowed the same principles of rigid adjustment that guided the ancient in his proportions to assist him in his. But the contrast appears in the increased and enlarged conceptions of the latter as compared with the condensed beauties of the former, different to Burlington who seldom starts into any thing grand, or deals in gradations of feature. If the ancient has unity, expression or variety, so has Palladio. If the one has a subordination of parts so has the other:—the difference is in the extent. That correct sentiment which assisted the depressed model of antiquity, aided the giant structure of the middle ages, whilst a harmony of relation belongs to the mansions of Palladio, no less than to the temples of Rome. Burlington appears but faintly to realize these ideas of relative beauty, there is no grand feature to which others are subsidiary. In Palladio's front the giant superficies displays degrees of importance amidst its many subservient members; and it is not until the more considerable images have been scanned, that the lesser contrivances are seen. The resemblance in style between Burlington and Palladio is in the smaller auxiliaries only, where the variety is uniform, like rhymes in poetry, alternately, and where variety has its variety, "like the stanza."

It must be remembered, in conclusion, that Burlington had to follow the Italian at a great distance, and to digest a new style at a time when refinement and conceptions of the beautiful faintly existed. Remembering this, whilst looking at the monuments of taste he has left us, we see his ready talent, and that pleasing display of native genius, wanting only a closer study from the same models, and the same attention to the true elements of grandeur to have rivalled, if not to have surpassed him.

Frederick East.

January, 1841.

REPLY TO EDER'S REMARKS ON THE ARCHITECTURE OF LIVERPOOL.

Sir—Seeing that the remarks of "Eder," on the Architecture of Liverpool have obtained a place in your Journal, and consequently an importance which they had not when they first appeared in a paper of this town, I will, with your permission, examine them a little.

I will agree with "Eder" that the Railway Station is a great failure, but I should much like to learn from him how a front should be designed, "which by its outward appearance should tell of the great things going on behind it."

It is amusing to observe writers like "Eder" laying down dogmas such as "Every edifice should express its object. A church should display gravity and dignity, a theatre lightness and gaiety, a prison rude majesty and sturdy strength, in short every edifice should like the countenance express spirit." "In short," comes in here very well, for the writer could not furnish another illustration. What should a Bank display? a Custom House? a Market? But "Eder" has solved the latter query by telling us that the Fish Hall "presents a very quiet plain portico expressive of its object;" so then on seeing "*a very quiet plain portico*," we may rest assured of its being the entrance of a fish market! A few axioms of this kind would render guides and guide-posts unnecessary. Unfortunately, however, the proprietors do not seem to consider the portico "expressive of its object," for they have caused the words "Fish Hall" to be painted in large letters on the architrave. So great is my dullness that I never yet saw a portico which expressed its object, unless that was to keep off the rain and sun.

Eder calls the "North and South Wales Bank one of the handsomest in town," it is true that the ground is "irregular in shape," the front being a little more than a right angle, so little however as not to be worth mentioning; it is also true that the architect has been "compelled to obtain in height what he wanted in superficies, and yet here are *enormous* difficulties overcome, and a handsome building in conclusion remains." The "*enormous difficulty*" consisted in building a bank three stories in height. Now for its beauty. The front consists of a Corinthian portico *in antis*, being about three times its width in height, the columns and pilasters are crowded together, between the columns there are a door, and two tiers of windows scarcely large enough for a third rate house; the front is made about one foot narrower than was necessary to obtain less projection in the cornice of one flank, so that by this happy idea you have this foot in width sticking on what ought to have been the return of the pilaster, and decorated with the rustic work, belts, &c. of the flank, which have no connection with the front. This I confess is a "handsome" way of getting over the "enormous" difficulty of reducing the projection of the cornice. The flank which is exposed to view is a strange jumble of pilasters, paltry doors and windows of all sorts and sizes, some Greek, some circular headed, some with swelled friezes—scarcely a foot of plain masonry is to be seen here. The architect has rigidly copied the columns and entablature from an ancient example, but he has misapplied and misarranged them, and the order which charms by its lightness and grace, the spectator in the Campo Vaccino, seems here clumsy and heavy, and the substructure does not seem half strong enough to carry the entablature. The ornamental parts of the order are passably executed; all the others both in design and execution (no man *could* make those things on the principal door architrave ornamental), are most wretched. To conclude, this building has cost an enormous sum. I shall probably return to this subject, meanwhile

I remain, your's, &c.

Seyton.

Liverpool, January 19, 1841.

Ancient Trees of the Spanish Chestnut.—Although certainly not a native of this country, England produces some exceedingly remarkable specimens of this valuable tree. In Betchwork Park, near Dorking, there are some Spanish chestnut trees of extraordinary size and great age, certainly the largest and oldest in that part of the country. There are about 80 trees, all of large dimensions. The subjoined table exhibits the circumference of some of the largest, taken about three feet from the ground:—

No. 1	17	2	No. 8	18	0
2	20	6	9	21	4
3	17	10	10	18	4
4	17	0	11	19	3
5	17	2	12	20	2
6	18	0	13	18	0
7	19	2	14	23	0

No certain record, I believe, exists of the age of these trees, but they are probably coeval with the first Betchworth Castle, founded in 1377, when "John Fitzalan, second son of Richard, Earl of Arundel, had license to embattle his manor-house here."—*Gardeners' Chronicle.*

UPON THE ARCHITECTURE OF ITALY.

A Translation of the Observations contained in the Preface to M. Percier's work, entitled "Palais et Maisons de Rome;" with some Additional Remarks upon that Preface.

By Arthur Wm. Hakewill.

The object of the following observations from the pen of M. Piercer was to induce his countrymen to bestow pains upon the smallest, as well as upon the most important works, and to anybody conversant with the French modern architecture, it must appear that the architectural productions and writings of that great architect have had their effect, France now being enlivened and beautified by numerous works upon a small scale, carefully and picturesquely designed. M. Percier was the very man to propagate principles with success; to great talent he united great amiability, and the precepts which he taught made a lasting impression, for they found their way to the minds of his pupils through their hearts, of which he had entire possession. He is now lost to France, to which country he has bequeathed a rich legacy, in the numerous skilful architectural productions and sage precepts which he has left, and the name of Percier will be long cherished, not only by a grateful country, but by all those who are sincerely devoted to the art in which he who possessed that name so greatly excelled.

It being constantly a subject of remark, that works upon a small scale in this country do not receive all that care and study so necessary to give them their full effect, it would appear that the observations alluded to might be as beneficially applied to England in the present day as they were to France formerly.

The English architect seems to think that great works alone require great exertion; it must be confessed that on such occasions he seldom fails to rise to a level with his subject, and Ste. Genevieve at Paris, compared with St. Paul's in London, either in *design* or construction, appears a toy. But it is not an occasional building of this kind that shows a nation fond of architecture, or which tends greatly to the decoration of a country; these two ends can only be compassed by the architect fairly appreciating the scope of his art, by considering it as an artificial landscape which mankind create to themselves; and therefore endeavouring to bestow on each production, however insignificant in size, all that study, care, and attention, of which the subject is susceptible, in order to produce a legitimate variety in his compositions, and to impart to each work a *correct* and *peculiar* character.

M. Percier says—

"Architects, upon their arrival at Rome, for the purpose of studying their art, will naturally bestow their first attention upon the valuable remains of antiquity, upon those imposing masses which, having resisted the ravages of time and barbarism, announce to posterity the grandeur and power of the Romans.

"After this first view, their admiration will be divided between such beautiful monuments and those which either the piety of the Popes, or the magnificence of the Roman princes, gave rise to in the fifteenth century, at the revival of the arts.

"Drawing and engraving, by multiplying the master-pieces of ancient architecture, have, as it were, laid Rome before the eyes of all; from the study of these buildings, some men of genius were enabled to deduce the elementary principles of architecture, they have taught us how to view these buildings and contrast them, whilst, by their own example, they have shown us how very possible it was to make a successful application of those fine models, upon occasions which might seem to offer but little scope for creating interest.

"This observation has, for a long time, escaped the attention of architects visiting Italy: it was thought that the studies to be made in that beautiful land, could only benefit artists who had great buildings to construct, whilst every thing which did not carry with it a certain degree of importance, was to be abandoned to the routine and caprice of workmen.

"But there are in Italy, and particularly in Rome, a vast number of charming habitations, which, under the most simple forms, bear the stamp of a refined taste, and prove to the attentive architect, that credit may be obtained in bestowing care upon the most humble production, and this reflection should be a consolation to those who profess an art, in which a very rare combination of fortunate circumstances can alone furnish the opportunity of being entrusted with the execution of great works.

"If such men as Bramante, Vignola, Palladio, Sangallo, and Peruzzi, have discovered in antiquity models for the buildings which they have erected, if these successful practitioners of the art have known how to apply, even in their slightest works, such admirable distribution, so agreeable an arrangement of parts, that refinement, *too*, which constitutes the great charm of their works, why should *we* not, when similarly circumstanced, endeavour to emulate them?

"It is with the liveliest feelings of interest that we behold the great artists whom we have just mentioned, bestowing, upon the simple habitation of the citizen, the same degree of spirit, care, and refinement of taste, which they have manifested in the erection of temples and sumptuous edifices. They have embellished every thing, and their pencils have thrown a charm over the modest retreat of the philosopher, in no way inferior to that of the palace of the prince.

"Penetrated with the importance of their art, they have taught us how to rid it of the prejudices of routine and the extravagancies of caprice, they have taught us to take nature for our guide, and her imitators for our models; and have, in some measure, restored architecture, in bringing back the art to its true intent. We ever perceive them skilfully availing themselves of the peculiarities of the site, and fulfilling, with admirable address, the various requisites of the design. Manifesting ingenuity even in the minutest detail, they never appear to have worked at random; they seem to have felt that nothing could be considered beautiful in architecture which was not authorized by some recognized utility; that true genius did not consist, as some moderns have thought, in waging war with reason to create novelties, and produce bizarre effects, but rather in the art of successfully applying the means which nature points out, which the site furnishes, and which the work in hand demands.

"It is in thus fulfilling these conditions that they have succeeded in imparting to each work its proper character, and it is thus that, ever guided by good taste, they have been enabled to make us lose sight even of the very difficulties they had to combat.

"Indeed, the greater part of their works bear the impress of that rare simplicity which, like some revealed truth, always appears so intelligible to those to whom it is disclosed.

"Their buildings are picturesque without being confused, possess symmetry but are not monotonous, and being carefully executed, frequently unite, to express ourselves in terms of art, the freedom of the sketch with the precision of the more finished performance.

"We contemplate, with unceasing admiration, the ingenuity displayed in the application of the various materials, such as marble, stone, brick, wood, &c., few examples of which are to be found elsewhere.

"It must be confessed that hitherto the Italian architects have excelled those of other nations. To produce the greatest effect with the most simple means, seems to have been the object of their ambition; whereas we, on the contrary, seem to take an opposite aim. It would appear, by the greater part of our modern works, our apartments ingeniously circumscribed, our petty distributions, our plaster columns, bronzed wood, and painted marbles, that we delighted in imitation, contenting ourselves with appearances.

"We will not seek to unveil the real causes of this degradation of the art, we cannot think that it has been brought about through motives of economy; for it would not be difficult to prove that such imitations, far from being less costly, entail, on the contrary, continual expences, both from the short time they last, as from the enormous prices set upon such works by skilful workmen.

"We might, perhaps, with regret, pronounce it to be a proof that architecture has never been held in great estimation among us; for the circumstance of a town containing a temple, a monument, a palace, is no argument that the fine arts have made it their abode; the tyranny, pride, or caprice of a single individual, may, for the moment, have chained them to the spot. But when, at every step, our attention is arrested by some masterpiece of magnificence, or even of simplicity: when in every spot we meet with monuments erected for the public good, the minutest detail characterized by that delicacy of taste which proclaims a whole nation to have been cultivators of the fine arts; then it is that we feel we are in Italy, and that that gifted land has long been their fixed abode.

"It is in that country alone that the most humble habitation offers to the attentive architect beauties, not very imposing, perhaps, in point of scale, but more immediately adapted to the wants of the community. It is to be observed that the charm of these buildings results from the arrangement of the plan and distribution of the masses, and not to a vain profusion of ornament.

"We do not pretend to say that the buildings which we have cited should be servilely copied, nor do we quote them as being entirely free from defects; we are also aware that our climate, materials, and habits, often prescribe other forms. But still we may safely assert, that by following the method which the Italian architects have pursued in their compositions, in considering them relatively to the conditions they had to fulfil; in short, *by studying them*, an attentive architect will know how to reap advantage from the light which they throw upon his art."

Thus far our author.

In the course of these observations there is one which it may be allowable to remark upon, viz., the conviction that comes over the mind of the traveller in Italy, that that favoured land has once been the fixed abode of architecture. In her flight from Greece to Italy, architecture alighted upon a congenial soil, and flourished through the land, owing to the solicitude of the inhabitants in courting her stay among them. The Italians soon found that architecture was their domain, and set about studying it in that vigorous manner in which a nation endeavours to effect any object influencing its honour; the chief requisites for an architect being ascertained, they were early inculcated, and geometry and drawing were made the basis of excellence; indeed, most of the Italian architects drew like painters; all dwell upon the importance of that art in their writings, and manifest it by the *vigour*, *delicacy*, and *choice of detail*, in their buildings; and one of them, Scamozzi, treats of it in terms of veneration, and says "that since, by means of drawing, that is so easily expressed which cannot be described, even by a multiplicity of words, we may rightly say that this art should be rather considered as a heavenly gift than as a mere discovery of human invention"—in the original thus:

"Di modo che, per via del disegno, si esprime molto facilmente tutto quello, che non può far la moltiplicità delle parole expresse, o descritte in carta, e per ciò, a ragione si può dire, che il disegno sia piu tosto dono celeste di Dio, che cosa ritrovata dall'ingegno humano"—

We may clearly see that it was not because architecture was practised by Italians, that the art made steady progress towards perfection, but because the Italians, appreciating the art, studied it in a legitimate manner, resting their claims upon the intrinsic merits of their compositions, and having no recourse to the blandishments of art, either to make a parade of their beauties, or to screen their defects; hence it was that buildings, promising comparatively but little upon paper, when erected became a real embellishment, creating delight and surprise, answering completely the description of a French writer, who says that a building should suit as a model to an architect, as a subject for the painter, and as an object of attraction to the general observer.

A very little reflection will make us feel that the course we pursue is very different from that pursued by the Italians of the fifteenth century, and those who once shed a lustre upon this nation during its great periods of art.

It is ever essential that the means taken should be commensurate with the end proposed; and as the end here is great, the means should be so too. Architecture is a severe art, and consequently should be severely studied. *Geometry*, the *orders*, the human form, foliage, the countless and various objects of nature, are fit subjects for the serious attention of the student of so delightful, comprehensive, and sublime an art as that of architecture. Doubtlessly, there are many accomplishments which, if not pursued to the detriment of more solid acquirements, add greatly to the perfection of the architect. But may it not be asked whether we of the present day pay not too much attention to these accomplishments, viewing them rather as the fit materials for the foundation of our studies, than as what they should be considered, the accessorial embellishments of the uperstructure.

Foremost, then, among these accomplishments, is that of water colour painting, which, from the developement given to it of late, appears amongst us a new art; there can be no doubt that, in the hands of a judicious architect, this art may prove a valuable acquisition; but indiscriminately pursued and applied, as it frequently is with us, as a substitute for accuracy of form in drawing, it may act as a serious check to the progress of architecture. It has this pernicious quality, it easily captivates the mind of the student, and early destroys that relish for those more severe studies which are so necessary to his future excellence. Through the means of water colour painting, defects in architectural composition are frequently cloaked, which, when the building is in progress, appear in all their nakedness, to the mortification and *surprise* of the employers, and to the lasting discomfiture of the architect; and doubtlessly the forced and conventional style of setting off perspective views has led to the complaint so often heard in this day, that buildings, at their completion, fail to produce the effect they had in drawing, in short, that the drawing was a deception; we may feel assured that so fallacious a system is wholly incompatible with the attainment of excellence in so severe an art as that of architecture, and that if we wish to leave behind us buildings which shall strike posterity, as those buildings which the Italians have left do us, we must be content to submit ourselves to the same sage and sober method of studying which those great masters pursued, and then we shall enter the field with an advantage in our favour; for be it remembered, that the Italian architects were obliged to glean, from the works of their Roman ancestors, all they knew of Greek architecture; whereas, to us is disclosed the *mine* of Greek art itself, enabling us to go at once to the fountain head of taste, and of obeying, to the very letter, the advice which the Roman poet gave to his countrymen, when he told them to study the works of the Greeks by day and by night:—

"———— vos exemplaria Græca
Nocturnâ versate manu, versate diurnâ."—HOR.

ON THE STANDARD OF ARCHITECTURAL BEAUTY AND SYMMETRICAL FORM.

By JOHN ROOKE, ESQ., *Author of "Geology as a Science.*

IN what may be called our own day, architectural forms that avowedly go by the name of taste, would seem to have fallen into all but ideal conceptions. A train of discussion has however been introduced into the Architect's Journal, based on the pure freedom of criticism, which is likely to uproot the inveterate conceits of the past ere long. Heaven's laws are all founded on omniscience, directed by the infinite wisdom of Almighty power. Were the universe divested of symmetrical proportions, by which each part sustains its duties in an infinite system, or bereft of the divine will, Chaos would necessarily lay prostrate the harmony of the heavens. But this is not so. God rules. Mind is more mighty than passive substance. Physics place the signet of universal truth on this comprehensive law, so conspicuously shown in all that comes within our means of observation. Mind has rendered all substance a self-acting instrument *on substance* by the adoption of such unification of purpose. We must believe in this ere we shall be able to take in science a single step, which is not empirical. All magnitudes of substance, which the intelligence of man is able to convert into substantial forms, and in which that substance operates upon itself, speedily fix their own limits, and would therefore break down under the influence of excessive weight. In the hands of heaven's laws, the extent of symmetrical harmonies is illimitable in magnitudes and exactness of proportions, in perfect conformity to a unity in design, worked by physics, as created by a Godhead, whose Almighty dominion nothing is either too extensive nor too small.

We may put our definitions on extent, and call this science, yet it is nothing beyond an amusing bubble, until we apply such definitions to the investigation of physical extent and combination in active forces. By such means we discover the universal and varied forms in which physics exist, and learn our own ignorance in the perfections and exactness of natural laws, even in the most trivial details, worked to their distinct ends, by that all-seeing mind which has made itself known through the medium of organic substance, working itself into like ends and means that are employed by man, when he embodies his conceptions and will in works of stone, wood, iron, or other materials, causing them to assume a self-working form for some end desired.

We so far observe two classes existing in forms of art. Those of heaven; and those of lowly man. In the first class, the more we study them, the more we find the adaptation of their provisions suited to their several uses. We find both a due quantity and quality of the materials employed to produce the ends required, neither more nor less, and taking the precise form held in view for attaining the object designed. This principle is constant in each and all of the works of the Deity, however opposite may be the magnitudes of such organic framework. The spheres of the heavens are so exactly adjusted in magnitudes as to retain their places truly; and work out those comprehensive changes in the phenomena of our earth which geology, as a science, based on the unity of divine wisdom, so plainly figures out to us. Though the earth may fly in its orbit at the rate of 68,000 miles in each hour, and turn on its axis more than 1000 an hour, yet these mighty motions, otherwise certain to disturb the waters of the earth, and cause them to roll over the most lofty eminences, have been effectually bridled by a depository process, which has made a fruitful land, symmetrical in surface lineaments, to appear from beneath those proud waves which have been thus stayed. By the same lofty destinies, and by the application of similar laws, every secure haven for ships, found on the borders of the great deeps, has its origin. We find the sturdy oak provided with sufficient strength of timber, and durability of quality to withstand the blasts of almost ten centuries. In that slim animal the hare we find material enough to impart to her the strength requisite for speed, without any of that unnecessary lumber, which would retard her foot, and operate as a drag upon her course. The greyhound may excel her in stride, and be able speedily to overtake her; yet her adaptation for turning more readily than her pursuer, chiefly owing perhaps to her more supple joints and less bulk, is suited for preservation. The ox, the horse, the elephant, and indeed

all other animals, are framed on symmetrical and mathematical rules which serve their wants and contribute to their preservation. So that we detect a unity prevailing throughout, which we must accept as constituting the only symmetry, harmony, or beauty which can exist—because the best uses are always made of any sum of materials in hand. All this exhibits the means by which in every instance conception and will gain an ascendancy over passive material bodies, and impart to them unity in beauty and adaptation to their uses. Symmetrical correspondences, which all admit to be a rule of beauty when truly adapted to their several purposes, form by no means an ideal taste, but a geometrical and mathematical rule rigidly observed in every instance. Who would recommend the drawing of circles and squares by taste? Nobody. Even a school-boy with his compasses and rules of art by which such figures are formed, would far outstrip in exactness of outline, the most accomplished artist that ever lived, had he no help except mere taste.

Coupling these observations with what has been given by the correspondents of the Architect's Journal, on the geometrical and mathematical harmonies of Gothic Architecture, it is plain that a fresh spirit in architectural design has been evoked. We claim for our day the age of science and civilization, and yet on what evidences does the claim depend? Do we prove our assumptions by a belief in the universal harmony of physics, springing from the causation of Almighty wisdom; or by the self-sufficiency of an empiricism, which utterly denies all connexion between philosophy and the laws of heaven? Why is it not obvious that we have a philosophy distinct from every religious consideration; and religious impressions which disclaim all evidences from philosophy; evils obviously existing because violent and bewidered extremes can neither agree with true science, nor with the purity of religion and morals. Mind is a universal power, of the mysteries of which we know nothing, except that it always works in pure physic according to geometrical and mathematical forms, upon the nearness of which to our frail bodies or distance from them we are totally unable to speculate.

Let this be accepted as the religious and philosophic belief of the English monks in the thirteenth century, as shown by the symmetrical harmony of their ecclesiastical edifices, and our ignorance and vanity are at once apparent. Yet no sooner do we observe scepticism, religious indifference, or bigotry creep into the public mind, than we find a decay in Gothic Architecture first appearing; and in less than two centuries it may be said to have been wholly lost, insomuch as the uniformity of geometric and mathematical rules were concerned. The purity of Gothic Architecture, (what a contemptuous name!) obviously sprang from the religious purity of the English monks in the thirteenth century, believing, as they must have done, that Almighty volition is manifested in the exactness of physics, geometrically and mathematically balanced in every work of the divine will. If we collect our proofs of this, from the day of Bede, in the eighth century, to that of Roger Bacon, in the thirteenth century, we shall discover one of the chief means, by which, in these five Gothic centuries, as we vainly call them, architecture and science had risen to a state of pre-eminence, which ought to make us blush for our own day, and acknowledge what lessons of wisdom we yet owe to the works of the Gothic barbarity bequeathed to us. Most unfortunately, according as papal bigotry and superstition vitiated the religious purity of every succeeding day, an opposite error crept in; and the world became all but divided between a superstitious despotism, which denied all reason in philosophy, and either a scepticism or a religious indifference, which promulgated a philosophy, independent of every religious consideration. In three centuries the lamp of genius, so brilliantly lit up at the fountain of heaven's laws, as evinced in the geometrical and mathematical exactness of Gothic Architecture, went out, and gave place to a race of imperfect copyists.* There can be no beauty but that which is symmetrically and mathematically adopted to the uses and ends held in view. Decoration, on all the rigidity of these severe rules, is displayed in every surface lineament of our globe; it is a scene of uses and beauties combined by the modus operandi of attributes divine. Ignorance may either overlook or deny this; and scepticism in the weight of its prejudices may vainly strive to hide the lamp divine under a bushel of follies, yet it is mildly bursting into the face of day in spite of either dullness supreme, or wilful blindness the most obtuse.

Ere such the proud day of success arrives, a vast preparation must be made. We must see distinctly what it is that we want. We must forego all baseless taste; and put a physical taste in its place. Neither papal superstition, nor its opponent scepticism, based on the foolish conceits of vain men, can serve us in the mighty acquisitions to be gained. These have not promoted, but retarded a development of those noblest faculties in man, which alike raise the standard of our religious belief, our moral qualities, and the perfections of our civil institutions. For not a little remarkable is it, that the age, which furnished us architectural remains so splendid, preserved if not matured our free institutions, amidst a period of turbulence and violence disturbing Europe at large. What I humbly ask then is, that men so well qualified as Mr. Cresy and Mr. Bartholomew, should go on and fear nothing.

[These remarks border too much on transcendentatism to be within the usual scope of our columns, but as we know they represent faithfully the ideas of a large class both here and abroad, we should have considered ourselves as neither doing justice to the subject nor the author, had we not availed ourselves of his proffered permission to consult our own taste in suppressing such portions of the paper as were not conformable to our views.—Editor.]

* We trust the learned author will excuse us for omitting some too flattering compliments to ourselves.

ENGINEERING WORKS OF THE ANCIENTS, No. 1.

The Persians.

Engineering has its archæology as well as architecture, the monuments of the Egyptians, of the Persians, of the Romans, are subjects which interest every class of readers. To some it may appear that the profession of a civil engineer is but of modern growth, it certainly may be so considered as regards its recent progress, but to the attentive observer a long chain of history is visible which records the labours of engineers, not for hundreds of years merely, but for thousands. On the engineering profession therefore the contemplation of the works of their predecessors is imposed as a task, if they are at all desirous that their successors should pay the same homage to themselves. The works of classic authors abound with accounts of interesting works, the descriptions of some of which we mean to copy into the Journal, as into a common-place book, trusting that it can never be considered useless to any man to contemplate the glories of the past. For this purpose we shall from time to time put down as they occur to us, extracts from the several authors, who have left materials for the subject of our enquiries.

Our present paper will principally be devoted to the works of the Persians and the Babylonians, which belong to one of the first schools of which we have authentic records. The history of this period forms the first in the annals of engineering, as now taught in this country, for the rudiments of the science laid down by the Persians, have, by successive nations, been transmitted to us. Persia being, like Egypt, a country traversed by a large river, and requiring extensive hydraulic works, naturally led to considerable proficiency in this branch, which would naturally be later of introduction among the continental Greeks, to whom it was taught by the Ionians in the Persian service. The Persian monarchs, independently of their own engineers, also became masters of the services of those of Egypt, Babylon, and Phœnicia, each of which, as we shall see, had also peculiar opportunities of study. From the Greeks engineering passed to the Romans, and so through the middle ages down to the present time, affording an example, paralleled in few professions, of rules of practice being transmitted uninterruptedly for more than twenty-five centuries, and illustrated from the earliest period by specimens now existing.

The materials for the ensuing descriptions are principally derived from Herodotus, who had authentic sources of information as to most of the works which he described. They are, as before stated, chiefly hydraulic works, and illustrate much of the antiquities of that important department of engineering.

Canal of Mount Athos.—Cutting.—The God of the Engineers.

In the course of the war of the Persians against the Greeks about the year 484 B. C., Herodotus* relates that, in order to avoid shipwreck on the dangerous coast of Mount Athos, Xerxes determined on cutting through the isthmus by which it is joined to the mainland, and so making a canal for the passage of his fleet. Herodotus says that three years were spent upon this work, the Persian fleet having been ordered to the port of Eleus in the Chersonese, and all the forces on board being compelled by turns to dig, and open a passage through the mountain. In this they were assisted by the adjoining inhabitants, and the direction of the works was confided to Bubaris, the son of Megabyzus, and to Artachæus, the son of Artæus, both Persians.

Athos is described as a mountain of considerable magnitude, leaning upon the sea, and well inhabited, (now, we may observe, by monks). It terminates to the landward in the form of a peninsula, and makes an isthmus of about twelve stades (a mile and a half) in length. The

* Polymnia 7.

peninsula so formed consists of a plain with a mixture of little hills, from the coast of Acanthus to that of Torone. On the mountain and other parts were the towns of Dion, Olophyxus, Acrothoon, Thysus, and Cleone, and on the isthmus stood Sana. The Persians having drawn a line before the town of Sana, divided the ground among the several nations; and when the trench was considerably sunk, those who were in the bottom stages contrived to dig, and delivered the earth to men standing on ladders, who handed the same again to such as were placed in a higher station, till at last others who waited to receive the burthen at the edge of the canal, carried it away to another place. But by digging in a perpendicular manner, and making the bottom of equal breadth with the top, all the workmen, except the Phenicians, drew a double labour upon themselves: because the earth, as it is natural, fell down continually in great quantities from the upper parts. The Phœnicians alone, continues Herodotus, shewed that ability, on this occasion of which they are so much masters at all times; for they opened the part which was assigned to their care twice as large as others had done; and sloped the ground gradually till they came to the bottom, they then found the measure, equal with the rest. So much for the mode of cutting pursued two thousand three hundred years ago. We are thus enabled to ascertain the origin of the slope, and the period at which its recognized introduction into the art took place. The number of workmen employed, says our author, was so great that in a meadow adjoining they had a market furnished with great abundance of corn brought even from Asia, and there was also a temporary court of justice formed perhaps on the piepoudre system. Herodotus is by no means disposed to approve of the necessity of the work, for he rather ascribes it to ostentation, being of opinion that it would have been much easier for Xerxes to have had his fleet carried over the land. The canal was of a sufficient breadth to carry two ships sailing in front, and at each end were deep trenches to prevent the sea from filling it up, it was completed by the time the Persian army arrived at Acanthus, in the neighbourhood (about 481 B. C.)—At this time died Artachæus, one of the engineers, who appears by all accounts to have been one of the greatest men of the day, for he was in stature the tallest of all the Persians, and wanted only the breadth of four fingers to complete the full height of five regal cubits; his voice also was stronger than that of any other man. By descent he derived his blood from the noble family of Achæmenes, and was much esteemed by Xerxes, who greatly lamented his death, and caused him to be interred with great pomp. All the army was employed in erecting a monument to his memory; and the Acanthians, admonished by an oracle, honoured him as a hero with sacrifices and invocations. "Such," says Herodotus, "were the demonstration which Xerxes gave of his concern for the loss of Artachæus;" and thus did the profession obtain the patronage of a demigod from their own body, to whom if they like they may build temples at this day.—In the meanwhile we suggest to our antiquarian friends, whether the Persian engineers swore by Artachæus, and whether any devout modern would be justified in using the same ancient form.

The fleet, it seems, according to orders from Xerxes, passed through the canal of Mount Athos, and so into the bay on the other side. Our author further adds, that the people of Acanthus, in consideration of the great attention they paid in making the canal, were rewarded by the king with vests of honour.

In the Babylonian district, the people were, as in Egypt, well supplied with canals, principally for the purposes of irrigation, the water being distributed from them by manual labour, or by hydraulic engines. The largest of these canals,* continued with a south-east course from the Euphrates to that part of the Tigris where Nineveh stands, and was capable of receiving vessels of burthen. These canals and the river were navigated by a peculiar kind of skin boat or coracle, to which Herodotus devotes particular attention.

PASSAGE OF RIVERS.—THE HALYS—THE GYNDES—THE EUPHRATES—THE DANUBE—THE STRYMON.

In the course of the war of the Lydians against the Persians, Crœsus found it necessary to cross the river Halys,† when by the advice of Thales, the Milesian it is said, that he caused the river to be divided into two branches, as if he were going to make a bridge—the diversion of streams being a resource well known to the ancient engineers both of the east and the west. He sank a deep trench, which commencing above the camp, from the river, was conducted round it in the form of a semicircle, till it again met the ancient bed. It thus became easily fordable on either side.

Cyrus in his war with the Babylonians made use of a similar expedient, with regard to the river Gyndes, but from other motives. The Gyndes is described by Herodotus (Clio) as rising in the mountains of Matiene, and passing through the country of the Darmeans, loses itself in the Tigris. Whilst Cyrus was endeavouring to pass this river, which could not be performed without boats, one of the white consecrated horses boldly entering the stream, in his attempts to cross it, was borne away by the rapidity of the current and totally lost. Cyrus, exasperated by the accident, made a vow, that he would render this stream so very insignificant, that women should hereafter be able to cross it without so much as wetting their knees. He accordingly put off his designs against Babylon, and divided his forces into two parts: he then marked out with a line on each side of the river, one hundred and eighty trenches; these were dug according to his orders, and so great a number of men were employed that he accomplished his purpose, but thus wasted the whole of that summer. It is supposed however that he was induced to undertake this work for the purpose of averting some omen.

On his arrival at Babylon, however, he had to carry on hydraulic works with a more important end. Finding the city strong and well provided, and that its reduction by force or famine seemed impracticable he had to take other measures. He placed one detachment of his forces where the river first enters the city, and another where it leaves it, directing them to enter the channel and attack the town wherever a passage could be effected. After this disposal of his men, he withdrew with the less effective of his men to a marshy part of the river, near which there was a kind of reservoir, said to have been constructed by Nitocris, Queen of Babylon, not long before. Cyrus here pierced the bank, and introduced the river into the lake, by which means the bed of the Euphrates became sufficiently shallow for the object he had in view. The Persians in their station watched the proper moment, and when the stream had so far drawn off as to be no higher than their thighs, they entered Babylon without difficulty.

Darius Hystaspes* in his expedition against the Scythians ordered a bridge to be thrown over the Ister or Danube by the Ionians. It was placed two days passage from the sea, at that part of the river, where it begins to branch off, but of its mode of construction nothing is said, although it may be inferred that it was of boats. Darius, when he arrived at the Ister, passed the river with his army, he then commanded the Ionians to break down the bridge, and to follow him with all the men of their fleet, but by the advice of Coes, a Mytilenian officer, he allowed it to remain, leaving it under the guard of the Ionians, with orders if he did not return in sixty days to break it down. The Scythians knowing this sent a deputation to the Ionians to persuade them to break down the bridge, or to maintain it only for the stipulated time, to which latter proposition they assented. The delay of sixty days having however expired, the Ionians by the advice of Histiæus of Miletus, still maintained the bridge for the Persians, but to prevent the Scythians cutting off the retreat, broke that portion near the Scythian shore. Darius arriving in the night with his army, Histiæus with the fleet restored the bridge.

Bubaris and Artachæus, the engineers of the Mount Athos canal, were also charged during the campaign of Xerxes against the Greeks, with the construction of a bridge over the river Strymon in Thrace. For these bridges, says the author so frequently quoted,† Xerxes provided cordage made of the bark of the biblos, and of white flax. This is all the account we have received of the bridge, except that the army afterwards passed over.

PASSAGE OF SEAS.—BOSPHORUS—HELLESPONT—GULF OF SALAMIS.

Darius,‡ having determined on an expedition against the Scythians, gave orders to throw a bridge over the Thracian Bosphorus, or as it is now called the canal of Constantinople. This bridge was placed at Chalcedon, or as Herodotus conjectors nearly midway between Byzantium and the temple at the entrance of the Euxine, constructed under the direction of Mandrocles, a Samian, who executed it so much to the satisfaction of Darius, that he made him many valuable presents. With the produce of these presents Mandrocles caused a representation to be made of the Bosphorus with the bridge thrown over it, and the king seated on a throne, reviewing his troops as they passed. This he afterwards consecrated in the temple of Juno, with an inscription paraphrased by Beloe thus—

> Thus was the fishy Bosphorus inclos'd,
> When Samian Mandrocles his bridge impos'd:
> Who there, obedient to Darius' will,
> Approv'd his country's fame, and private skill.

This is perhaps one of the earliest instances of a votive offering, and of an artistical commemoration of an engineering work.

* Herodotus, Clio.
† Herodotus, Clio.

* Herodotus—Melpomene.
† Herodotus—Polymnia.
‡ Herodotus, Melpomene.